Incoming
C0070013
#3541

UtahAmerican Energy, Inc.

COPY

Lila Canyon Project
P. O. Box 910
East Carbon, Utah 84501
Phone: (435) 888-4000
(435) 650-3157
Fax: (435) 888-4002

July 5, 2010

Daron Haddock
Permit Supervisor
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, Utah 84114-5801

Re: UtahAmerican Energy, Inc. Horse Canyon Mine, 10-006 Clean Copies of 10-004, Task ID #3541

Dear Mr. Haddock,

Attached you will find six (6) clean copies of amendment 10-004 for incorporation to the MRP.

The additional bond in the amount of $113,000.00 will follow.

Should you have any questions please call.

Sincerely,

R. Jay Marshall

File in:
☐ Confidential
☒ Shelf
☐ Expandable
Date Folder 070710 C/0070013
See: Incoming For additional information

RECEIVED
JUL 07 2010
DIV. OF OIL, GAS & MINING

Application for Permit Processing
Detailed Schedule of Changes to the MRP

COPY

Surface change deficiencies Task ID #3017 10-001	Permit Number: ACT/007/013
	Mine: Horse Canyon "Part B" Lila Canyon
	Permittee: UtahAmerican Energy, Inc.

Provide a detailed listing of all changes to the mining and reclamation plan which will be required as a result of this proposed permit application. Individually list all maps and drawings which are to be added, replaced, or removed from the plan. Include changes of the table of contents, section of the plan, pages, or other information as needed to specifically locate, identify and revise the existing mining and reclamation plan. **Include page, section and drawing numbers as part of the description.**

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 1 Text Page 13
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 1-1 Murray Energy Holdings Information to End of Section 1
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 1-3 (All)
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 1-2
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 2 Text All
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 2-1
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 2-2
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 2-3
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 2-4
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 3 Text Pages 13, 19, 20, and 39
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 4 Text Page 3
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 4-3 (Air Quality)
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 5 Text (all)
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 5-4 (All)
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 5-5 Pages 16-20 with new Pages 16-19
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 5-7 (All)
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 5-8 Text Page 1
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-1A
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-2

Any other specific or special instructions required for insertion of this proposal into the Mining and Reclamation Plan?

COPY

Application for Permit Processing
Detailed Schedule of Changes to the MRP

Surface change deficiencies Task ID #3017 10-001

Permit Number: ACT/007/013

Mine: Horse Canyon

Permittee: UtahAmerican Energy, Inc.

Provide a detailed listing of all changes to the mining and reclamation plan which will be required as a result of this proposed permit application. Individually list all maps and drawings which are to be added, replaced, or removed from the plan. Include changes of the table of contents, section of the plan, pages, or other information as needed to specifically locate, identify and revise the existing mining and reclamation plan. **Include page, section and drawing numbers as part of the description.**

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-5
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-6
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-7 A1
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-7 A2
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-7 A3
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-7 A4
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-7 B1
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-7 B2
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-7 B3
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-7 C
☐ ADD	☐ REPLACE	☐ REMOVE	Plate 5-8
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 6-2 end (rock slope material analysis)
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	Chapter 7 Text Pages: TOC, 1-94. Keep Pages 95-End"
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 7-3 Page 21
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 7-4 (ALL)
☐ ADD	☐ REPLACE	☐ REMOVE	Plate **7-2, 7-5**, 7-6A 7-6B
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	Appendix 8-1 (all)
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	
☐ ADD	☐ REPLACE	☐ REMOVE	

Any other specific or special instructions required for insertion of this proposal into the Mining and Reclamation Plan?

APPLICATION FOR PERMIT PROCESSING

Permit Change ☐	New Permit ☐	Renewal ☐	Transfer ☐	Exploration ☐	Bond Release ☐	Permit Number: ACT/007/013

Title of Proposal: Surface change deficiencies Task ID #3017 10-004

Mine: Horse Canyon

Permittee: UtahAmerican Energy, Inc.

Description, include reason for application and timing required to implement:

Instructions: *If you answer yes to any of the first 8 questions (gray), submit the application to the Salt Lake Office. Otherwise, you may submit it to your reclamation*

☐ Yes	☐ No	1. Change in the size of the Permit Area? _____ acres Disturbed Area? _____ acres ☐ increase ☐ decrease.
☐ Yes	☐ No	2. Is the application submitted as a result of a Division Order? DO #
☐ Yes	☐ No	3. Does application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes	☐ No	4. Does application include operations in hydrologic basins other than as currently approved?
☐ Yes	☐ No	5. Does application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes	☐ No	6. Does the application require or include public notice/publication?
☐ Yes	☐ No	7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes	☐ No	8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes	☐ No	9. Is the application submitted as a result of a Violation? NOV #
☐ Yes	☐ No	10. Is the application submitted as a result of other laws or regulations or policies? Explain:
☐ Yes	☐ No	11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes	☐ No	12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2?)
[illegible]	☐ No	13. Does the application require or include collection and reporting of any baseline information?
☐ Yes	☐ No	14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes	☐ No	15. Does application require or include soil removal, storage or placement?
☐ Yes	☐ No	16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes	☐ No	17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes	☐ No	18. Does the application require or include water monitoring, sediment or drainage control measures?
☐ Yes	☐ No	19. Does the application require or include certified designs, maps, or calculations?
☐ Yes	☐ No	20. Does the application require or include subsidence control or monitoring?
☐ Yes	☐ No	21. Have reclamation costs for bonding been provided for?
☐ Yes	☐ No	22. Does application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes	☐ No	23. Does the application affect permits issued by other agencies or permits issued to other entities?

X **Attach 3 complete copies of the application.**

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

R. Jay Marshall 4/08/10
Signed - Name - Position - Date

Subscribed and sworn to before me this 28 day of April, 19 2010.

Mary V. Kava
Notary Public

My Commission Expires: May 16, 19 2012
Attest: STATE OF Utah
COUNTY OF Carbon

MARY V. KAVA
NOTARY PUBLIC • STATE of UTAH
COMMISSION # 574269
COMM. EXP. 05-16-2012

Received by Oil, Gas & Mining

RECEIVED
MAY 03 2010
DIV. OF OIL, GAS & MINING

ASSIGNED TRACKING NUMBER

RECEIVED
JUL 07 2010
DIV. OF OIL, GAS & MINING

BRIGHAM YOUNG UNIVERSITY
Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
801-422-2147

Sample #1
+50

Plant and Animal Science Department

SOIL TEST REPORT AND RECOMMENDATIONS

Name: Uath American Energy, Inc.
Street: 794 N. 'C' Canyon Rd
East Carbon, UT 84520
City State Zip

Date: 24-Apr-09
Telephone: 435-888-4000
Fax: 435-888-4002

Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Rock Slope Material	Turf	8.07	63.72	23.72	12.56	Sandy Loam		0.09

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recommendations
Nitrate-Nitrogen ppm N	20.55			X			apply 60 lbs of N/ac
Selenium ppm Se	1.53						
Boron ppm B	0.45						
Salinity-ECe dS/m	8.40					X	salinity a problem for most crops
Moisture % 1/3 bar	10.72						
Moisture % 15 bar	2.50						
Moisture % Avail.	8.22						
SAR-Sodium Absorption Ratio	6.67		X				no sodium hazard
Calcium-SAR ppm Ca	552.00						
Magnesium SAR ppm Mg	344.50						
Sodium SAR ppm Na	814.08						
Sulfur % S	0.02						apply 20 lbs of S/ac
Ca Carbonate %CaCO3	6.33						
Total N ppm total N	0.00						
Acid-Base pot. tons/1000 tons	64.32						No Problem

units corrected 4/21/10

BRIGHAM YOUNG UNIVERSITY
Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
801-422-2147

Sample # 2
1400

Plant and Animal Science Department

SOIL TEST REPORT AND RECOMMENDATIONS

Name: Utah American Energy
Street: P.O. Box 910
City: East Carbon State: Utah Zip: 84520

Date: 19-Apr-10
Telephone: 435-888-4000
Fax: 435-888-4002

Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Sample 1, submitted 7-15-09	Turf	7.71	49.36	18.08	32.56	Sandy Clay Loam		

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recommendations
Nitrate-Nitrogen ppm N	2.37	X					apply 120 lbs of N/ac
Nitrogen ppm total N	451.20		X				
Selenium ppm Se	0.75		X				
Salinity-ECe dS/m	8.00					X	salinity a problem for most crops
Carbon % Carbon	2.24						
% Moisture -1/3 bar	12.95						
% Moisture -15 bar	7 37						
% Available Moisture	5.58						

Notes:

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
801-422-2147

Sample #2
+490

Plant and Animal Science Department

Name: Utah American Energy
Street: P.O. Box 910
City: East Carbon State: Utah Zip: 84520

SOIL TEST REPORT AND RECOMMENDATIONS

Date: 19-Apr-10
Telephone: 435-888-4000
Fax: 435-888-4002

Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Sample 1 submitted 7-15-09	Turf	7.71	49.36	18.08	32.56	Sandy Clay Loam		

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recommendations
SAR-Sodium Absorption Ratio	25.22					X	extreme sodium hazard exists
[illegible]um-SAR ppm Ca	302.24						
Magnesium SAR ppm Mg	125.44						
Sodium SAR ppm Na	2073.60						
Ca Carbonate %CaCO3	8.30						
Neutralizing Pot. Tons/ 1000 tons	83.00				X		
Sulfur %Sulfur	0.50						
Acid Potential Tons/ 1000 tons	15.59		X				
Acid Base Pot. Tons/ 1000 tons	67.41				X		very good
Boron ppm B	1.73			X			no fertilizer needed

Notes:

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
801-422-2147

Road Slope #:
Soil Sample

Plant and Wildlife Sciences Department

Name: Utah American Energy, Inc.
Street: 794 N. 'C' Canyon Rd.
City: East Carbon State: UT Zip: 84520

SOIL TEST REPORT AND RECOMMENDATIONS

Date: 19-Apr-10
Telephone: 435-888-4000
Fax: 435-888-4002

Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Carbon
Sample 1, submitted 10-8-09	Turf	7.65	50.72	29.72	19.56	Loam		1.36

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recommendations
Nitrate-Nitrogen ppm N	2.46	X					apply 120 lbs of N/ac
Selenium ppm Se	0.74						
Boron ppm B	5.09						
Salinity-ECe dS/m	9.20					X	salinity a problem for most crops
Moisture % 1/3 bar	12.84						
Moisture % 15 bar	6.14						
Moisture % Avail.	6.70						
SAR-Sodium Absorption Ratio	12.66			X			potential sodium hazard
Calcium-SAR ppm Ca	550.40						
Magnesium SAR ppm Mg	427.52						
Sodium SAR ppm Na	1635.84						
Sulfur % Sulfur	0.68						
Ca Carbonate %CaCO3	11.36						
ppm total N	385.20						
Acid-Base pot. tons/1000 tons	92.36						no problem

Notes:

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
801-422-2147

Sample #4
+804 #2

Plant and Wildlife Sciences Department

Name: Utah American Energy
Street: P.O. Box 910
City: East Carbon State: Utah Zip: 84520

SOIL TEST REPORT AND RECOMMENDATIONS

Date: 15-Jan-10
Telephone: 435-888-4000
Fax: 435-888-4002

Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Sample 4	Turf	7.71	45.08	41.80	13.12	Loam		

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recommendations
Nitrate-Nitrogen ppm N	4.32	X					apply 120 lbs of N/ac
Total Nitrogen ppm total N	134.60	X					
Selenium ppm Se	0.15	X					
Salinity-ECe dS/m	3.10			X			no salinity problem
Carbon % Carbon	2.12						
% Moisture -1/3 bar	13.06						
% Moisture -15 bar	3.58						
% Available Moisture	9.48						

Notes:

Sample #4
+804 #2

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
801-422-2147

Plant and Wildlife Sciences Department

SOIL TEST REPORT AND RECOMMENDATIONS

Name: Utah American Energy
Street: P.O. Box 910
City: East Carbon State: Utah Zip: 84520

Date: 15-Jan-10
Telephone: 435-888-4000
Fax: 435-888-4002

Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Sample 4	Turf	7.71	45.08	41.80	13.12	Loam		

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recommendations
SAR-Sodium Absorption Ratio	4.99		X				no sodium hazard
Calcium-SAR ppm Ca	159.84						
Magnesium SAR ppm Mg	186.88						
Sodium SAR ppm Na	394.24						
Ca Carbonate %CaCO3	11.48						
Neutralizing Pot. Tons/CaCO3	114.80					X	
Sulfur %Sulfur	0.44		X				
Acid Potential Tons/CaCO3	13.59		X				
Acid Base Pot. Tons/CaCO3	101.20					X	Very good
Boron ppm B	1.14			X			no fertilizer needed

Notes:

Sample #5
cover material

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
801-422-2147

Plant and Wildlife Sciences Department

Name Utah American Energy
Street P.O. Box 910
East Carbon Utah 84520
City State Zip

SOIL TEST REPORT AND RECOMMENDATIONS

Date: 15-Jan-10
Telephone: 435-888-4000
Fax: 435-888-4002

Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Sample 5	Turf	7.53	19.44	55.44	25.12	Silt Loam		

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recommendations
Nitrate-Nitrogen ppm N	1.50	X					apply 120 lbs of N/ac
Total Nitrogen ppm total N	212.90	X					
Selenium ppm Se	0.12	X					
Salinity-ECe dS/m	5.20				X		salinity a problem for sensitive crops
Carbon % Carbon	2.42						
% Moisture -1/3 bar	13.85						
% Moisture -15 bar	6.64						
% Available Moisture	7.21						

Notes:

Sample #5

Cover Material

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
801-422-2147

Plant and Wildlife Sciences Department

Name Utah American Energy

Street P.O. Box 910

East Carbon Utah 84520
City State Zip

SOIL TEST REPORT AND RECOMMENDATIONS

Date: 15-Jan-10
Telephone: 435-888-4000
Fax: 435-888-4002

Sample Identification	Crop to be grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Sample 5	Turf	7.53	19.44	55.44	25.12	Silt Loam		

Soil Test	Results	Very Low	Low	Medium	High	Very High	Recommendations
SAR-Sodium Absorption Ratio	1.71	X					no sodium hazard
Calcium-SAR ppm Ca	542.72						
Magnesium SAR ppm Mg	832.00						
Sodium SAR ppm Na	273.92						
Ca Carbonate %CaCO3	17.93						
Neutralizing Pot. Tons/CaCO3	179.30					X	
Sulfur %Sulfur	0.03	X					
Acid Potential Tons/CaCO3	0.91	X					
Acid Base Pot. Tons/CaCO3	178.40					X	Very good
Boron ppm B	3.60				X		no fertilizer needed

Notes:

Soil Test	Test 1 50 Sandstone	Test 2 420 Mudstone	Test 3 710 Mudstone/Silts	Test 4 804 #2 Sandstone	Test 5 cover material Loam
Nitrate-Nitrogen	20.55	2.37	2.46	4.32	1.50
Selenium	1.53	0.75	0.74	0.15	0.12
Boron	0.45	1.73	5.09	1.14	3.60
Salinity-ECe	8.40	8.00	9.20	3.10	5.20
Moisture % .3	10.72	12.95	2.84	13.06	13.85
Moisture % 15	2.50	7.37	6.14	3.58	6.64
Moisture % Avail	8.22	5.58	6.70	9.48	7.21
SAR-Sodium	6.67	25.22	12.66	4.99	1.71
Calcium-SAR	552.00	302.24	550.40	159.84	542.72
Magnesium SAR	344.50	125.44	427.52	186.88	832.00
SodiumSAR	814.08	2073.60	1635.84	394.24	273.92
Sulfur	0.02	0.50	0.68	0.44	0.03
Ca Carbonate	6.33	8.30	11.36	11.48	17.93
Total N	0.00	451.20	385.20	134.60	212.90
Acid-Base Pot.	64.32	67.41	92.36	101.20	178.40

Looks Good
Priscilla
1/25/10

Horse Canyon Extension
Lila Canyon Mine

Chapter 7
Hydrology
09-003

Volume 6 of 7

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Chapter 7

700. HYDROLOGY

710. Introduction

711. General Requirements

711.100 The existing hydrologic resources of the proposed Lila Canyon Mine area are detailed under section 720.

711.200 The proposed operations and potential impacts to the hydrologic balance are described in Sections 728 and 730.

711.300 All methods and calculations utilized to achieve compliance with hydrologic design criteria and plans are described in Section 740 and Appendix 7-4.

711.400 Applicable performance standards

711.500 Reclamation hydrology is described in Section 760 and in Appendix 7-4.

712. All cross sections, maps and plans required by R645-301-722 as appropriate, and R645-301-731.700 have been prepared and certified according to R645-301-512.

713. Impoundments will be inspected as described under Section 514.300:

A professional engineer or specialist experienced in the construction of impoundments will inspect the impoundment.

Inspections will be made regularly during construction, upon completion of the construction, and at least yearly until removal of the structure or release of the performance bond.

The qualified, registered professional engineer will promptly, after each inspection, provide to the Division, a certified report that the impoundment has been constructed and maintained as designed and in accordance with the approved plan and the R645 Rules. The report will include discussion of any appearances of instability, structural weakness or other hazardous conditions, depth and elevation of any impounded waters, existing storage capacity, any existing or required monitoring procedures and instrumentation and any other aspects of the structure affecting stability. (See Appendix 5-2 for the inspection form).

A copy of the report will be retained at or near the mine site.

There are no impoundments at this site subject to MSHA, 30 CFR 77.216; therefore, weekly inspections are not required.

Impoundments not subject to MSHA, 30 CFR 77.216 will be examined at least quarterly by a qualified person designated by the operator for appearance of structural weakness and other hazardous conditions.

720. Environmental Description

721. General. The following information will present a description of the existing, pre-mining hydrologic resources within the proposed permit and adjacent areas. This information will be used to aid in determining if these areas will be affected or impacted by the proposed coal mining activities.

The proposed Lila Canyon Mine is located, in the southwestern portion of the Book Cliffs in Emery County, Utah, approximately 2 miles south of the old Horse Canyon Mine, formerly operated by Geneva Steel Company. The proposed mining will be in the Upper (and possibly Lower) Sunnyside Seam of the Blackhawk Formation.

Existing hydrologic resources of the area consist of: Surface water resources - intermittent by rule with ephemeral flow streams; and Groundwater resources - springs and seeps and perched, isolated aquifers. These resources have been evaluated using hydrologic data from the Horse Canyon Mine, water level piezometers, and seep/spring inventory data of the proposed mine and adjacent areas. Plates 7-1 and 7-1A show the locations of the surface drainages, springs and seeps, and piezometers.

722. Cross Sections and Maps

722.100 Subsurface Water. The locations where subsurface water, including springs and seeps, have been identified are presented on Plates 6-1 and 7-1 and data results are included in Appendix 7-1. Relevant cross sections of subsurface water, geology, and drill holes are shown on Plate 6-1. Where sufficient data are available, the seasonal head differences are presented on contour maps (see Figure 7-2A) and on a piezometer hydrograph plot (see Figure 7-2B).

722.200 Surface Water. Location of all streams and stockwatering ponds or tanks in the area of the mine are shown on Plate 7-1. There are no perennial streams, lakes or ponds known to exist within the proposed permit or adjacent areas.

A new diversion work was thought to have been constructed by the BLM in 2004 at the confluence of the Right Fork of Lila Canyon and Grassy Wash. Water from this diversion was directed to the stock pond located in Section 28, T. 16 S., R 14 E. Figure 1 in Appendix 7-9 shows the location of the diversion and the alignment of the diversion channel to the stock pond. Also, the location of the overflow channel back to Grassy Wash is also presented on the figure. However, the BLM was not involved in the pond improvements. Recent site investigation 2006 shows that the diversion structure described in Appendix 7-9 has been breached and no flow now reaches the pond from Grassy Wash. No other ditches or drains are known to have been constructed in the area of the mine.

722.300 Baseline Data Locations. Locations of all baseline data monitoring points are shown on Plate 7-1. Baseline water quality and quantity data is included in Appendix 7-1.

722.400 Water Wells. Three wells and three piezometers have been identified in the permit and adjacent areas. Two wells are located within the alluvium of lower Horse Canyon Creek. Three water piezometers were drilled in the area, IPA #1, IPA #2 and IPA #3, to monitor mine water levels. Drill hole S-32 was drilled and converted to a water monitoring hole by Kaiser in 1981. The details of these wells and piezometers are discussed in Section 724.100 of the application. The location of all these wells and piezometers is shown on Plate 7-1. No information on any other wells has been identified.

722.500 Contour Maps Contour Maps of the proposed disturbed area and mining areas are included as Plates 5-2A, 5-2B, 7-1 and 7-2. These maps use U.S.G.S. based contours and accurately represent the proposed permit and adjacent areas. Disturbed area maps present greater detail from low-level aerial photography, for greater detail, and are tied to relevant U.S.G.S. elevations to ensure correlation between the maps.

723. Sampling and Analysis

All water quality analyses performed to meet the requirements of R645-301-723 through R645-301-724.300, R645-301-724.500, R645-301-725 through R645-301-731, and R645-301-731.210 through R645-301-731.223 will be conducted according to the methodology in the current edition of "Standard Methods for the Examination of Water and Wastewater" or the methodology in 40 CFR Parts 136 and 434. Water quality sampling performed to meet the requirements of R645-301-723 through R645-301-724.300, R645-301-724.500, R645-301-725 through R645-301-731, and R645-301-731.210 through R645-301-731.223 will be conducted according to either methodology listed above when feasible. "Standard Methods for the Examination of Water and Wastewater" is a joint publication of the American Water Works Association, and the Water Pollution Control Federation and is available from the American Public Health Association, 1015 Fifteenth Street, NW, Washington, D.C. 20036.

724. Baseline Information

This section presents a description of the groundwater and surface water hydrology, geology, and climatology resources to assist in determining the baseline hydrologic conditions which exist in the permit and adjacent areas. This information provides a basis to determine if mining operations can be expected to have a significant impact on the hydrologic balance of the area.

724.100 Ground Water Information. This section presents a discussion of baseline groundwater conditions in the permit and adjacent areas. The data set consists of piezometer, spring and seep inventory data, mine discharge, and mine inflow information from the abandoned Horse Canyon Mine. Appendices 7-1 and 7-6 provide data through the 2002 sampling period. All of these data and other recent data are available in the DOGM electronic database. The data, provided in Appendices 7-1 and 7-6 and the DOGM electronic data base, were obtained from multiple sources, including (but not limited to) on-site sampling efforts, the Horse Canyon Mine P.A.P. filed by Geneva Steel and annual reports, U.S. Geological Survey publications, and various consultant reports. Since not all monitoring parties were required to adhere to UDOGM or SMCRA rules, the laboratory parameters varied between reports. However, the data are still considered valid and appropriate for determining baseline conditions within the permit and adjacent areas. The location of the sampling points are presented on Plates 7-1 and 7-1A.

History of Data Collection. The U.S. Geological Survey conducted a water quality study in Horse Canyon from August 1978 until September 1979 during the time that U.S. Steel operated the mine. Samples were taken monthly from the Horse Canyon Creek and analyzed for most major ions and cations and field parameters. Metals, eight nitrogen species and other minor chemical constituents were taken on a quarterly basis or less.

Between January 1981 and April 1983, baseline water quality data was collected for four surface water/spring sites B-1, HC-1, RF-1 and RS-2, and 3 UPDES Discharge Points, 001 (Mine Discharge), 002 (Mine Discharge) and 003 (Sewer Plant) , on the Horse Canyon permit area. Between 14 and 19 samples were taken and analyzed during the monitoring period depending on the site. The parameters that were analyzed were derived from Section 783.16 in the regulations. DOGM monitoring guidelines were not in force at that time.

Two other sites, RS-1, and RS-2, were sampled once a year during 1978, 1979, and 1980 and analyzed for most major chemical constituents. In addition, springs H-1, H-6, H-18, and H-21 were sampled once by JBR and analyzed for the major constituents in 1985. Third quarter data for 1989 were collected for B-1, HC-1, RF-1, and RS-2 and sampled for most of the parameters in DOGM's guidelines.

Sample sites B-1, HC-1, RF-1 and RS-2, along with the UPDES Discharge Points 001A and 001B, have been monitored quarterly since 1989 in accordance with the approved water monitoring plan for the Horse Canyon Mine (Part A). The results of this monitoring have been submitted to the Division each year with the Annual Report and or have been entered into the Divisions electronic data base.

Baseline monitoring was also conducted on the proposed Lila Canyon Mine extension area by Earthfax Engineering in 1993-1995. Some 60 sites were identified and monitored. This data is presented in Appendix 7-1.

The operational water monitoring program committed to the permit application was implemented in July, 2000. Data will be collected from new monitoring sites L-1-S through L-4-S. L-5-G has yet to be installed. These sites are typically dry and no quality data has been gathered as yet. Sites L-6-G through L-10-G have been monitored for baseline in 1993, 1994, and 1995. These sites, along with piezometers IPA-1, IPA-2 and IPA-3, were monitored in December 2000 to determine if they were still viable and to establish a current baseline that will be continuous with operational monitoring.

Sites L-11-G and L-12-G were added in October 2001 to replace sites L-6-G and L-10-G. Sites L-13-S, L-14-S, L-15-S, and L-18-S are being used to determine flow characteristics of the Williams Draw Wash, Wash below L-12-G, Little Park Wash, and Stinky Springs Wash.

Sites L-6-G, L-10-G and L-15-S were determined to either provide no flow data or data that was less representative than the replacement sites and will be suspended from sampling in the 1st quarter of 2003.

Wells. The wells in the mine area consist of two water supply wells, three water level piezometers, and an exploration borehole converted to a monitoring well.

Two wells are located within the alluvium of lower Horse Canyon Creek, near the Horse Canyon Mine. These wells area completed in the aerially small, alluvial aquifer at the mouth of Horse Canyon which contains groundwater likely collect from infiltration of surface flows from the upper Horse Canyon area. As indicated in Section 722.400, the well located near the main Horse Canyon surface facilities, identified as Horse Canyon well on Plate 7-1A, is still open, although not operational at this time. The well was investigated and it was determined that it would not be useful as a piezometer. The pump is sitting on the top of a concrete cap encapsulating the top of the well. The site could not be used as a piezometer without removing the pump. This well will be donated to the College of Eastern Utah as part of the Post Mine Land Use Change. The well located near the road junction, identified as MDC well on Plate 7-1A, is an abandoned well owned by Minerals Development Corporation. This well has been sealed to the operator's best knowledge. No hydrologic data is presently available from either of these wells.

Three water level piezometers were drilled as part of plans to access the Kaiser South Lease by I.P.A. These piezometers were designated IPA-1, IPA-2 and IPA-3, and are located in the Lila Canyon Permit area (see Plate 7-1). IPA monitored these sites for water depth from 7/94 to 4/96. These monitoring results are included in Appendix 7-1 and monitoring points and measured water levels are shown on Plate 7-1. It should be noted that the monitoring of these holes was done over the 2 3/4 year period to provide baseline data for the South Lease by I.P.A. Monitoring of water depths at these points by UtahAmerican commenced in December 2000 and continued through present. As indicated by the data in Appendix 7-1, the water levels in the holes show very little fluctuation. Levels change from less than 1.2' to a maximum of 21.2' over an eight year monitoring period. Figure 7-2A and 7-2B present the seasonal fluctuations of the water levels as contour maps and hydrographs. Using these water levels, an estimate of the projected water level assuming that the zones from the individual piezometers are connected is shown on Plate 7-1 and the monitoring results are included in Appendix 7-1 - Baseline Monitoring.

The piezometers were installed to provide depth of water only. It is impossible to drop a bailer 1000 feet and withdraw a water sample without contaminating the sample. It has been suggested that sampling pumps be installed on these wells. Appendix 7-11 discusses the difficulties of using pumps and bailers in these piezometers. Due to limited pump capabilities in a 2-inch diameter well such sampling is not feasible. Therefore the depth and diameter of the piezometers holes make it impossible to use them for baseline quality sampling.

Drill holes S-26, S-27, S-28, and S-31 were cased in 3" PVC pipe with bottom perforations for water monitoring; however, cement seals were faulty, allowing the PVC pipe to fill with cement. Drill hole S-26 was reported dry in the week prior to cementing.

It has been reported by Kaiser that holes within one and one-quarter miles east of the cliff face were drilled with air, mist and foam and did not detect any water in the subsurface with the exception of drill hole S-32. No apparent increase in fluid level could be attributed to groundwater inflow from these holes, some of which were open for two weeks. Exploration drill holes in the South Lease property south of Williams Draw did not encounter groundwater within 1 to 1.25 miles of the coal outcrop. Exploration drill holes in the South Lease property, south of Williams Draw, did not encounter groundwater within 1 to 1.25 miles of the coal outcrop.

S-32 is located approximately three miles south of Lila Canyon and is separated from Lila by at least two known fault systems. The drill log along with the Chronology of Development and Pump tests are included in Appendix 6-1. Water levels measured are shown in the `"Chronology of Development". Water quality analysis for S-32 is also included in Appendix 6-1. These water quality data are representative of the completion zone of the well (Upper Sunnyside Coal Seam and zone beneath the coal). The location of S-32 is shown on Plate 7-1. The Permittee visited S-32 in 2002 and attempted to measure water levels, but found that piezometer S-32 was unusable.

Spring and Seep Data. JBR Consultants Group (1986) conducted a spring and seep inventory of the Horse Canyon area during the fall of 1985. During the study, no springs or seeps were located within the disturbed area or near the proposed surface facilities. Within and adjacent to the permit area, 19 springs and seeps were found. Flows occurred from either sandstone beds located over shales or from alluvium. The flow rates from the springs varied from less than 1 gpm to about 10 gpm. Table 7-1 shows the flow rates and field data for each site. Sample results are listed in Appendix 7-6.

Based on the data, nine of the springs occurred from alluvial deposits in the stream channels or in colluvium. Nine of the remaining springs discharge from sandstone located above less permeable shale. Spring (H-92) was developed by excavating into bedrock. The discharge from this spring is through a pipe.

An additional spring and seep survey was conducted in the area, including the proposed Lila Canyon Mine area, by Earthfax Engineering in 1993 through 1995. Results of this survey are included in Appendix 7-1 of this permit. This is the most consistent and most recent data; therefore, this data has been used for baseline monitoring in Appendix 7-1.

All of the spring and seep sites identified from the various surveys are presented on Plate 7-1A. The geologic source for the springs can be determined by comparing Plates 6-1 and 7-1 and 7-1A. Additionally, the elevation of the sampling points can be estimated from the topographic base map. All groundwater use (seeps and springs) within the permit and adjacent areas is confined to wildlife and stock watering.

It should be noted that a number of sample sites and monitoring holes have been noted in previous submittals. Sites A-26 and A-31 were mentioned in the Horse Canyon Mine Plan; however, these sites were drilled in 1981, and no data is available as to location and/or water quality data. These sites are considered non-usable for this plan. Sites H-21A, H-21B, H-18A, H-18B, HC-1A and an unidentified spring 1000' southwest of HCSW-2 have been mentioned; however, no sample data or pertinent information is available for these sites, and they have been removed from Plates 7-1 and 7-1A. Plates 7-1 and 7-1A have therefore been revised to show only seep/spring and other pertinent hydrologic data points for which adequate, reliable data is available for the plan.

Water rights for the mine and adjacent areas are addressed in Section 722.200 of this P.A.P.

Table 7-1
1985 Spring and Seep Survey Results

Spring ID	Temp (C°)	pH	Conduct. (umhos.)	Flow (gpm)	Occurrence	Use	Sampled
H-1	7	8.1	950	2	SS over Shale	wildlife	yes
H-2	10	8.0	1111	2	Colluvium	wildlife	no
H-3	-	-	-	<<1	Alluvium	wildlife	no
H-4	9	7.7	1229	1	Colluvium	wildlife	no
H-5	10.5	7.7	1359	1	Alluvium	wildlife	no
H-6	9	7.9	1366	10	SS over Shale	cattle	yes
H-7	9.5	7.6	1985	<1	SS	cattle	no
H-8	12	7.8	1997	<1	SS	wildlife	no
H-9	11	7.7	1919	2	Alluvial	cattle	no
H-10	11	7.9	2150	1	Alluvial	cattle	no
H-11	9.5	7.8	1227	2.5	Alluvium	cattle	no
H-13	11	7.1	1596	4.5	Colluvium	cattle	no
H-14	7	7.5	2040	2	SS over Shale	cattle	no
H-18	7	7.9	1381	9	Alluvium	wildlife	yes
H-19	8	8.2	645	3.5	SS over Shale	developed	no
H-20	14	8.3	777	2.5	SS over Shale	none	no
H-21	14	8.3	968	6	SS over Shale	wildlife	yes
H-22	5	8.3	322	1	SS over Shale	none	no
H-92	-	-	-	<<<1	SS over Shale	none	no

Mine Inflow Information. Based on the historic record, water was encountered underground in the Horse Canyon Mine, resulting in outflows from portal areas of approximately 0.2 cfs or 90 gpm. The size of the flows from pumping or from old portal discharges is more the result of the large size of the mine (approx. 1500 ac), rather than the result of intercepting a localized high flowing aquifer. If the flow is distributed over the mine area, the average inflow is about 0.6 gpm per acre. The water encountered was likely discharge from perched aquifers or saturated sandstone lenses encountered during mining, not uncommon in mines in the Blackhawk Formation.

According to mining records of U.S. Steel (previous owner), groundwater was monitored within the Horse Canyon mine in several locations. Generally, the underground flows occurred from roof drips or areas where entries encountered sandstone lenses. As discussed in the Blackhawk Formation description, the inflows were similar to inflows found in other mines along the Book Cliffs. This is thought to represent an interception of an isolated saturated zone in the subsurface. Generally, a saturated, perched sandstone lense which overlies the coal seam is intersected by the mining operation. This provides a flow path for the isolated water in the sandstone lense to drain into the mine. Over time as the volume of water in the sandstone lense decreases, the rate of discharge also decreases. Eventually, the inflow ceases as the available water in the lense is fully drained. This drying up of the inflow is indicative of a very limited recharge to the deep strata in area, which is consistent with the known horizontal and vertical hydraulic conductivity of the Blackhawk Formation.

Flows which issued from rock slopes and gob areas, where roof collapse may have occurred, were also small. These area would have exposed numerous points for inflow from sand stone lenses, roof bolts, and fractures within the formation. Therefore, it would be likely that if there were large amounts of water stored within the formation, the inflows from these area would have been significantly greater. The lack of these flows from these areas of the mine are a further indication that limited water was stored in the formation and that the recharge to the formation from overlying strata was also limited.

During the period from 1957 to 1962, an exploration test entry was mined south from the Geneva Mine into the Lila Canyon Area. This entry encountered in-place water, which was allowed to collect in short cuts made into the down dip entry which was sufficient to keep excess water from working areas. The exploration entry was terminated when the Entry fault was encountered (see Plate 7-1). More than two months was spent drilling to ascertain the nature of the fault and locate the coal seam. During this period, there is no mention in the records of excess water or that water was encountered in the Entry fault area.

There is no estimate of water quality retrieved while mining the exploration entry other than mentioned above. However, water flow and seeps were reported to be in the range of 1 to 24gpm.

Only when the mine neared the Sunnyside Fault was significant water encountered. The water was initially pumped for use in the water supply system for the mine. When inflows increased beyond in-mine needs, to keep the workings near the Sunnyside Fault from flooding, the mine pumped water collected from this area from the workings during the period 1980 through 1983, prior to suspending operations. The development plan for the mining within the Lila Canyon extension is planned to avoid the Sunnyside Fault. Therefore, the amount of water to be encountered underground will be limited.

The rate of inflow into the Horse Canyon Mine is not precisely known. In U.S. Steel's Permit Application Package (PAP) (1983) they estimated the average discharge from the mine to be 0.2 cfs. Lines and Plantz (1981, p. 32) also estimated the discharge from the mine to be 0.2 cfs and mentioned that the discharge was intermittent. It is not known, however, if this represents a constant average flow or the average flow rate during discharge periods. The mine was using an unknown volume of water within the mine for dust suppression and other operational needs.

According to the I.P.A. Mining and Reclamation Plan for Horse Canyon, Kaiser Coal re-entered the mine in 1986. They found that at the intersection of the Main Slope and 3rd level, at the rotary car dump, there was water in the bottom of the dump. The water level in the dump was described in the Horse Canyon P.A.P. as being "about 30 feet below the floor (personnel communication, 1990)". U.S. Steel monitoring site 2 Dip, a sump where water collected, is very near this location and has an elevation of 5,827 feet. Therefore, the water level in the rotary dump would be at a level of about 5,800 feet. No other water levels were obtained during 1986.

In 1993, BXG also re-entered the Horse Canyon Mine. They reported water levels at the rotary car dump at approximately 5870. It is not known if this reported level was for the same locations, but it is assumed to be the close to the same location. Due to the extended period without pumping, this water level is probably representative of the level of water collected in the rest of the mine. Therefore, to be conservative, it is assumed that the

Geneva exploration entries driven south from the Horse Canyon Mine into the proposed Lila Canyon mining area do contain water since the tunnels elevation is approximately 5855 feet.

The Horse Canyon Mine has been closed and the surface area reclaimed. With no significant inflow to the old workings, no discharges are occurring from any of the portal areas nor are expected in the future. It is known however, that water has collected in the old entries. As future mining activities, for the proposed Lila Canyon Mine, will be occurring near this area of collected water in the old exploration entry workings, it is likely that some of this water will be intercepted by the proposed Lila Canyon Mine (see Plate 7-1). Water may then have to be pumped from the mine. Because of undulating floor and unknown void areas, it is impossible to determine the amount of water that would be pumped. The rate of pumping, if any, would be determined by the water discharge system design. All water discharged from the mine would be discharged at UPDES Site # 002A which is Site L-5-G, and will meet all UPDES standards. DOGM has specified planning to include a mine discharge of 500 gpm maximum.

An inspection of the Horse Canyon area following mining has shown no diminution of reasonably foreseeable use of aquifers. Since mining ceased in 1983, subsidence should have occurred within two years. However, no deterioration of the aquifers in the area was identified. Mining has not yet begun on the Lila Canyon site; however, since the structure and groundwater regime is similar to the Horse Canyon area, no diminution or deterioration of groundwater resources is expected in this area.

As the mining in the Lila Canyon Mine will be from the same seam and the adjacent strata are the same and the over and underburden are the same, occurrences of ground water in the Lila Canyon Mine are expected to be similar to the Geneva Mine (Horse Canyon). The water quality is expected to be the same as the water encounter in the Horse Canyon Mine. Samples taken underground from the Horse Canyon Mine (MRP part "A" Appendix VI-1) to the north of the Lila Canyon Mine and from well S-32 (MRP part "B" Appendix 7-1) by Kaiser to the south of the Lila Canyon Mine show the water from the level of the coal seam to be a calcium, sodium-sulfate type water. Therefore, it is likely that the water from the strata between these two points from the same strata will be very similar.

Inflows of water encountered while mining are expected to reduce to seeps or dry up in a short period of time. If a significant water inflow is encountered, the water, which is not needed for underground operations, will be collected, treated as necessary, and pumped to the surface for discharge under the terms of the UPDES permit.

Groundwater Systems. In the Lila Canyon Lease area, the groundwater regime consists of two separate and distinct multilayered zones. The upper zone consists of the Wasatch Group which includes of the Colton Formation, the undifferentiated Flagstaff Limestone-North Horn Formation, and the Price River Formation. These formations contain groundwater in isolate, perched aquifers. These perched zones are classified as aquifers because they supply groundwater in sufficient quantities for a specific use (as specified by R645-100-200). The lower zone consists of the Blackhawk Formation (where the coal seams are located). This formation consist of low-permeable strata which contain groundwater in isolated saturated zones. Based on the definition in the State coal mine regulations (R645-100-200), there is no aquifer in the lower saturated zone, because the water is not developed for a specific use nor does the strata transmit sufficient water to supply water sources. Additionally, there is no discharge from this zone along any fault or fracture or in any adjacent canyons. The two zones are separated by the Castlegate Sandstone. This zone is a porous, fairly clean sandstone. According to Fisher, et.al. (1960), the Castlegate Sandstone does not have any shales, clays, siltstones, or mudstones. The lower zone is underlain by the Mancos Shale, a very impermeable marine shale.

Geologic conditions in the permit and adjacent areas are described in detail in Chapter 6 of this P.A.P. Though discussed in several publications for the general Book Cliffs area, formal aquifer names have not been applied to any groundwater system in the permit and adjacent areas because the geometry, continuity, boundary conditions, and flow paths of the groundwater systems in the area differ somewhat from the general published discussions. However, the data do suggest that groundwater systems in each of the bedrock groups are sufficiently different from each other to justify the informal designation of groundwater systems based on bedrock lithology. Thus, the informal designation of the Upper zone - Colton, Flagstaff/North Horn, and Price River and the Lower zone - Castlegate, Blackhawk, and Mancos groundwater systems is adopted herein.

The majority of groundwater in the permit and adjacent areas generally occurs within isolated, perched aquifers in the upper zone overlying the coal-bearing Blackhawk Formation. In the lower zone groundwater occurs in isolated saturated zones in the Blackhawk Formation. Hydrogeologic conditions within the permit and adjacent areas are summarized below:

Upper Groundwater Zone

Colton Formation. The Colton Formation outcrops in the northeast portion of the permit and adjacent areas. This formation consists predominantly of fine-grained calcareous sandstone with occasional basal beds of conglomerates and interbeds of mudstone and siltstone. Data presented in Plates 7-1 and 7-1A and Appendices 7-1 and 7-6 indicate that 16 springs issue from the Colton Formation within the permit and adjacent areas. The elevations and location of these springs vary greatly within the formation, indicating that the springs are isolated from each other and that they are not part of one aquifer.

Waddell et al. (1986) evaluated the discharge of springs in the formation for the period of June to September 1980. The measured discharge rate generally declined during the 4-month period of evaluation. This suggests that the groundwater system has a good hydraulic connection with surface recharge and that most of the annual recharge quickly drains out of the system. The limited flow indicates that the recharge is limited to small areas above the spring and not to a deeper groundwater syustem.

Groundwater issuing from the Colton Formation has a total dissolved solids ("TDS") concentration of 300 to 600 mg/l (as measured by specific conductance and laboratory analyses of TDS). The pH of this water is slightly alkaline (7.5 to 8.1). Insufficient data are available to describe seasonal variations in these parameters.

The water is a calcium-magnesium-bicarbonate type (see Appendix 7-1). The data also indicated total iron concentrations of <0.04 to 4.89 mg/l. Total manganese concentrations ranged from <0.01 to 1.29 mg/l.

Undifferentiated Flagstaff-North Horn Formation. The Flagstaff-North Horn Formation outcrops across much of the northern and central portion of the permit area. This formation consists of an interbedded sequence of sandstone, mudstone, marlstone, and limestone. Most springs and a major portion of the volume of groundwater discharging from the permit and adjacent areas issue from the Flagstaff-North Horn Formation. According to Plates 7-1 and 7-1A and Appendices 7-1 and 7-6, 36 springs issue from the Flagstaff-North Horn Formation within the permit and adjacent areas.

Groundwater discharge rates for springs issuing from the Flagstaff-North Horn Formation are greatly influenced by seasonal variations in precipitation and snowmelt, with most discharge corresponding to the melting of the winter snow pack during the spring months. Discharge is highest following the spring snowmelt and decreases to a trickle by the fall (Appendices 7-1 and 7-6). Many springs issuing from the Flagstaff-North Horn Formation have been noted to dry up each year.

Waddell et al. (1986), found that most of the annual recharge to the Flagstaff-North Horn Formation drains out of the system within about two months, while the remainder of the annual recharge drains out prior to the next snowmelt recharge event.

The groundwater regime in the Flagstaff-North Horn Formation appears to be influenced predominantly by the combined effects of lithology and topographic expression. Because the Flagstaff-North Horn Formation forms the upland plateau of the permit and adjacent areas, this formation is capable of receiving appreciable groundwater recharge from precipitation and snowmelt.

Waddell et al. (1986) concluded that the Flagstaff-North Horn groundwater system consists of isolated, perched water bearing lenses rather than a continuous perched aquifer. They indicate that approximately 9 percent of the average annual precipitation recharges the Flagstaff-North Horn groundwater system and that recharge water entering the Flagstaff-North Horn Formation moves downward until it encounters low permeability lenses of shale or claystone layers in the lower portion of the formation, where almost all of the water is forced to flow horizontally to springs.

Data presented in Appendices 7-1 and 7-6 indicate that groundwater issuing from the Flagstaff-North Horn Formation has a TDS concentration range of 400 to 700 mg/l. This water tends to be slightly alkaline and, similar to conditions encountered in the overlying Colton Formation, is of the calcium-magnesium-bicarbonate type.

The data presented in Appendices 7-1 and 7-6 indicate that the total iron concentration of groundwater discharging from springs in the Flagstaff-North Horn Formation is generally less than 0.04 to 0.15 mg/l. Total manganese concentrations in Flagstaff-North Horn groundwater are generally less than 0.03 mg/l. These data do not exhibit seasonal trends.

Price River Formation. The Price River Formation consists of interbedded mudstone and siltstone with some fine-grained sandstone and carbonaceous mudstone. Within the permit area, 17 springs have been found issuing from the Price River Formation as indicated based on data presented in Plates 7-1 and 7-1A and Appendices 7-1 and 7-6. Flows from these springs are limited in quantity and generally show a seasonal decrease with time, being high in the spring and reduce to very low or dry conditions in the summer. Such fluctuations indicate that these springs originate from limited recharge areas. Therefore, these springs are also part of a series of isolated, perched saturated zones or lenses and not part a regional aquifer system. Transmissivity in the Price River Formation is estimated by Waddell (1986) to be 0.07 ft^2/day or 0.00013 ft/day. Based on specific conductance measurements collected from these springs, the TDS concentration of water issuing from the Price River Formation varies from about 750 to 850 mg/l. The water is slightly alkaline, with a pH of 7.9 to 8.9.

Lower Zone

Castlegate Sandstone. The Castlegate Sandstone consists of a fine- to medium-grained sandstone that is cemented with clay and calcium carbonate. The outcrops of this sandstone form prominent cliffs in the area. No springs were identified in this formation, suggesting that it is not a significant aquifer. The absence of springs is of great significance, since this formation is situated between the overlying Upper groundwater zone (in the Colton, Flagstaff/North Horn, and Price River Formations) and the underlying lower zone (in the Blackhawk Formation). This lack of springs indicates that there is separation between the upper and lower groundwater zones. Most likely this zone is the result of two factors: 1) clay horizons in overlying formations inhibit vertical recharge from groundwaters in the Flagstaff-North Horn Formations, and 2) the exposed recharge area of the Castlegate Sandstone is limited primarily to areas of steep cliff faces.

Blackhawk Formation. The Blackhawk Formation underlies the Castlegate Sandstone and consists of interbedded sandstone, siltstone, shale, and coal. The lower Sunnyside coal seam, to be mined by UtahAmerican, is located in the upper portion of the Blackhawk Formation.

Across the formation, with the exception of the Sunnyside Sandstone, most of the individual sandstone bodies are discontinuous. This results in areas that are saturated; i.e. sandstone lenses; and areas that are dry; i.e. siltstone and shale sections. This discontinuous nature results in the typical pattern found in the mines of the Wasatch Plateau and the Book Cliffs. For this upper portion of the Blackhawk Formation, no regional aquifer has been identified. As mining advances an isolated area of saturation (perched aquifer) is encountered by the entry or by roof bolting or fractures due to subsidence. As the water from these isolated saturated zone drains into the mine it starts at an initially high rate and over time as the limited extent of the zone is emptied, the rate of flow decreases. Some zones which are laterally connected are able to reach a consistent inflow which is a balance for the recharge to the system with the outflow to the mine entry.

The hydraulic conductivity of the lower zone is believed to be about 0.01 to 0.02 ft/day, similar to values reported by Lines (1985) from the Wasatch Plateau for similar lithologies. Structural dip in the Lila Canyon area is about 6 to 7 degrees to the east. The gradient of the lower zone in the Horse Canyon/Lila Canyon area is probably less than 2 degrees.

The IPA water level piezometers (Plate 7-1) were completed within the first formation with identifiable water below the coal seam, the Sunnyside Sandstone of the Blackhawk Formation. EarthFax Engineering supervised the drilling of the monitoring bore holes for IPA. In all three piezometers, immediately below the coal seam, a mudstone layer was encountered. Above the mudstone layer no significant water had been identified. Below the mudstone layer, a sharp transition to a sandstone layer was encountered. This sandstone layer was identified as the Sunnyside Sandstone. Water was identified as occurring from the sandstone layer in each of the piezometers. According to the EarthFax completion logs, the screened zones in the piezometers were located within the Sunnyside Sandstone layer and a cement-bentonite seal was placed from the top of the sandstone layer to the ground surface of the piezometer. Thus, the water level measured in the piezometers is indicative of the conditions found within the sandstone layer.

Data collected from the piezometers (Appendix 7-1) indicate that the water in the sandstone is under pressure. In IPA 1, the water level is approximately 590 feet above the completion zone. In IPA 2, the water level is about 810 feet above the screened level. While, IPA 3 has a water level approximately 250 feet above the completion level.

Additionally, water levels in IPA 2 and 3 varied by approximately 2 feet during the period of July 1994 through April 1996, but showed no consistent trend. IPA 1 showed a rise of 5.6 feet over the same period. Measurements collected in 2001 indicated that the water levels in IPA 2 and 3 were 1 to 2 feet higher than the last time it was measured nearly 5 years earlier, while IPA 1 showed a rise of 16 feet. For the period since 2001, no trend has been identified for IPA 2 and 3, while IPA 1 has continued a slow increase. Although an increase in water levels has occurred during the period of record, this increase is not considered significant.

As the piezometers are completed in the same saturated zone, the piezometric surface shows that groundwater in the Sunnyside Sandstone to be moving to the northeast, into the Book Cliffs (see Plate 7-1). The gradient of the piezometric surface is approximately 0.011 ft/ft. The seasonal fluctuations between fall and spring are almost undistinguishable. Based on the tabulated data (Appendix 7-1), the fluctuation range is less than 0.5 feet between summer and fall readings. Figures 7-1 and 7-2 attempt to show these variations in contour map and piezometer hydrographs.

The water level piezometers show water levels above the lower zone containing the coal seam in area of the mine. However, as reported in the

Castlegate Sandstone section, no springs or water bearing zones were identified in the spring and seep inventories or in the drilling of the water level piezometers in the formation. Therefore, indicating that the piezometer monitored zones are under pressure and that the water identified in the upper zone is perched and isolated from the lower groundwater zone.

While the water in the Sunnyside Sandstone is under pressure, there was no indication during drilling that the coal seam was saturated. Similar conditions have been identified in other mines in the Wasatch Plateau and the Book Cliffs. It is likely that the water within the Sunnyside Sandstone will not affect mining unless the confining mudstone layer is breached.

It is possible that mining will intercept some water as it progresses down dip. However, as discussed previously regarding mine water inflows to the Horse Canyon Mine, it is expected that water quantities and quality will be similar to that encountered in the Horse Canyon Mine. While some pumping is likely for water from the isolated saturated zones within the lower groundwater zone; since the water in the upper groundwater zone appears to be perched aquifers 200 to 500 feet above the coal seams, no adverse effects on usable surface sources are expected.

No springs have been identified as issuing from the Blackhawk Formation (see Appendices 7-1 and 7-6 and Plates 7-1 and 7-1A).

The quality of groundwater in the Blackhawk Formation is characterized by the water quality of data collected from inflows to the Horse Canyon Mine, which is completed in the lower portion of the Blackhawk Formation. Both mines will be completed in the same coal zone. Therefore, the quality of the water encountered in the Lila Expansion is expected to be similar to the water encountered in the Horse Canyon Mine. These data indicate that Blackhawk Formation groundwater has a mean TDS concentration range of 1400 to 2400 mg/l and is of the calcium, sodium-sulfate type. These waters are chemically distinct from groundwater in overlying groundwater systems.

Quality and quantity of underground water is the most difficult to ascertain due to geologic variables such as faults, fractures, channel sands and isolation of these particular features when water is encountered in order to gain reliable samples. Underground water tends to be co-mingled with water from other places in the mine and water pumped through the mines for mine equipment and dust suppression. Thus, care needs to be taken to obtain representative samples. Specific undisturbed water samples of the subsurface inflows are not known to have been collected. However, the quality results reported in the Horse Canyon records are consistent with in-mine samples from adjacent mines.

The dissolved iron concentration of groundwater flowing into the Horse Canyon Mine has historically been less than 0.5 mg/l and is generally less than 0.1 mg/l (see Appendices 7-1 and 7-6). The total iron concentration of this water has historically been less than 0.7 mg/l and generally less than 0.1 mg/l. The total manganese concentration of Blackhawk Formation water (as measured in the Horse Canyon Mine) has historically been less than 0.05 mg/l and is typically less than 0.03 mg/l (see Appendices 7-1 and 7-6).

Mancos Shale. The Mancos Shale is exposed south and west of the permit area. This formation is a relatively impermeable marine shale and is not considered to be a regional or local aquifer. Groundwater samples collected from two monitoring sites located in Stinky Spring Canyon approximately 2 miles southeast of Lila Canyon Mine have a TDS concentration in the range of 2200 to 4200 mg/l and are of the sodium-sulfate-chloride type (Appendix 7-1). The flow rate for these two springs is less than 1 gpm, indicating the impermeable nature of the source formation. In the 1981 baseline study for the Kaiser Steel south lease permit document, Kaiser indicated that no springs were identified below the coal seam along the face of the Book Cliffs. Therefore, at that time, these springs were not flowing. Total iron concentrations ranged from 0.35 to 11.8 mg/l. Total manganese concentrations ranged from 0.05 to 0.29 mg/l. Chemical compositions of other parameters are consistent with waters from the Mancos Shale in the Book Cliffs area. The change in water type, from sodium-bicarbonate in the overlying Blackhawk Formation to sodium-sulfate-chloride in the Mancos, and the increased iron and manganese concentrations indicate that the Big and Little Stink spring waters are not from the same source, but are isolated waters from different recharge sources.

The two springs, which are located stratigraphically near the top of the Mancos Shale, appear to be fault related. As shown on Plate 7-1a, there is an east-west trending fault zone that is located within the canyon where Big and Little Stink Springs are located, referred to as the Central Graben. These two springs are located on the southern side of the northern fault of the graben. Due to the isolated nature of this graben block, being down dropped relative to the surrounding strata, within the highly impermeable Mancos Shale, it is unlikely that these springs are connected to any other water sources within the permit area. Further, the water quality and flow of the these springs, as discussed above, also indicate an isolated nature of the waters. Based on these results, the waters from Big and Little Stinky Springs are considered are from a localized, isolated saturated zone, but not part of a regional aquifer or an extensive saturated zone.

Recharge and Discharge Relations

Recharge in the permit and adjacent areas occurs from precipitation to the exposed strata. Plate 7-1a shows the major zone of recharge. This recharge area corresponds to the outcrop and exposure of the Colton/Flagstaff-North Horn Formations. No perennial surface water streams or surface water bodies exist within the permit or adjacent areas which contribute water to the groundwater systems. The majority of infiltration is a near surface occurrence into the alluvial fills within the drainages. The deeper sediments underlying the drainages (Blackhawk and Mancos) consist of low transmissivity strata which would prohibit the vertical movement of groundwater.

Recharge rates were calculated by Waddell and others (1986, p. 43) for an area in the Book Cliffs. Waddell estimated recharge at about 9 percent of annual precipitation. Lines and others (1984) indicate the mean annual precipitation along the Book Cliffs in the area of the Horse Canyon Mines is about 12 inches, indicating a recharge rate of just over 1 inch per year.

The recharge and discharge areas for local isolated, perched aquifers in the upper zone (Colton, Flagstaff-North Horn and Price River Formations) generally lie within the drainage areas of Horse and Lila Canyons. These local systems are complex in that they are discontinuous and lenticular in nature and highly dependent on topography. Recharge water from precipitation or snowmelt enters the Colton or Flagstaff-North Horn Formations and moves downward until it encounters low permeability shale or claystone layers or lenses in the formations, where almost all of the water is forced to flow horizontally to springs. The springs exhibits substantial variability in discharge in response both to spring snowmelt events and to drought and wet years. Discharge rates as great as 20 gpm have been recorded from the springs during the high-flow season, and discharge rates as low as 1 gpm are not uncommon during late summer. The effects of the drought occurring in the late 1980s and early 1990s are clearly evident in the flow records.

Recharge to the lower zone including the Castlegate Sandstone, Blackhawk Formation, and Mancos Shale is of limited magnitude, due to the limited area of exposure of the formations to steep outcrops and the presence of low-permeability units in overlying North Horn and Price River Formations. Additionally, the clay layers in the upper Blackhawk, which contain approximately 80 percent clays, siltstones, mudstones, and shales, are all highly restrictive to vertical groundwater movement (Fisher and others, 1960). Further, no surface water bodies are present to act a supply sources to the deep ground water system.

Recharge to the lower zone probably occurs primarily from vertical movement of water through the overlying formations and is probably greatest where surface fractures intersect the topographic highs where the upper zone formations outcrop. The rate of recharge to the lower zone is very slow. The lack of a significant recharge source results in limited discharge areas. The largest portion of recharge to the lower zone is in the Castlegate Sandstone and upper member of the Blackhawk Formation with some leakage from the upper zone where the greatest number of springs are identified.

The Sunnyside fault zone is the major feature throughout much of the Sunnysdie Mining District. Having a north-northwest strike, the fault zone extends from West Ridge to the Horse Canyon Mine. South of the Horse Canyon Mine the faults are not mapped at the surface. South of Horse Canyon, the faults are believed to be east of the Lila Canyon extension.

At the south end of the Lila Canyon Extension, a series of east-west trending faults have been mapped. These faults form the structure known as the Central Graben. The graben is a down dropped block relative to the adjacent strata.

Faults may effect flow, direction and magnitude of both lateral and vertical flows. However, the area is abundant with plastic or swelling clays that can seal faults and fractures inhibiting both lateral and vertical flows. As discussed in the mine inflow section, significant groundwater was only encountered in the Horse Canyon Mine as mining approached the Sunnyside fault zone. To prevent such inflows at the Lila Canyon extension, the mining plan attempts to avoid the fault zone. Also, exploratory mining by U.S. Steel, during the period 1952 to 1960, encountered the east-west trending Entry fault in the proposed Lila Canyon area. After extensive exploration, no significant water was encountered from the east-west trending fault.

Assuming mass-balance and stable hydrologic conditions, recharge will equal discharge over the long term. The relatively rapid groundwater discharge from the upper zone formations as compared with the underlying lower zone formations suggest that the stratigraphically-higher water discharges are local and are not hydraulically connected with the lower zone. Waddell et al. (1986) conclude that the perched nature of the upper zone formations protect them from the influence of dewatering of the coal-bearing zone unless the upper zone is influenced by subsidence.

Groundwater resources in the permit area are limited due to the small surface area and low recharge rates. There is not enough base flow from groundwater discharge to maintain a perennial flow in Horse Canyon Creek or Lila Canyon.

The upper groundwater zone produces low volume spring flows from up-dip exposures of bedrock and overlying alluvium. Some spring discharges from this zone have been developed and are used for livestock and wildlife. The lower groundwater zone has very limited discharges that are used for wildlife, generally during the early spring. Based on the location of these lower zone points and the vertical separation (500 feet) between the coal seam and the points, there is no possibility of mining impacting the springs.

Due to the lenticular, discontinuous, and vertically separated water bearing zones in the upper zone, it is not possible to develop a potentiometric surface or to show water level variations within these discontinuous aquifers. As described above, the nature of the discharge from the springs with time has been identified. Also, it is not possible, due to the discontinuous nature, to map the extent of the upper water bearing zones.

724.200 Regional Surface Water Resources. The permit area exists entirely within the Horse Canyon, Lila Canyon, and Little Park Wash watersheds. The regional drainage patterns are generally north-south with steep canyons which are incised in the Book Cliffs escarpment. Stream flows within the region, generally, are the result of snowmelt runoff or summer thunderstorms. Water is not abundant as evapotranspiration exceeds precipitation.

<u>Permit Area Surface Water Resources</u>

Within the permit area, the surface water resources consist of three main drainages: Horse Canyon Creek, Little Park Wash, and Lila Canyon. Horse Canyon flows to Icelander Wash which, in turn, flows to Grassy Trail Creek and the Price River. Little Park Wash flows southward to Trail Canyon and the Price River. Lila Canyon flows southwest to Grassy Wash, then south to the Marsh Flat Wash and the Price River (see Plate 7-1).

Surface water sampling data are available in Appendix 7-2 and in the DOGM electronic database. The data were obtained from multiple sources, including (but not limited to) on-site sampling efforts, the Horse Canyon Mine P.A.P. filed by Geneva Steel and annual reports, U.S. Geological Survey publications, and various consultant reports. Since not all monitoring parties were required to adhere to UDOGM or SMCRA rules, the laboratory parameters varied between reports. However, the data are still considered valid and appropriate for determining baseline conditions within the permit and adjacent areas. The location of the sampling points are presented on Plates 7-1 and 7-1A.

Based on field observations (described in Appendix 7-7) and flow data obtained during the collection of water-quality samples within the permit and adjacent areas, Horse Canyon Creek is considered intermittent by rule with ephemeral flow within the permit area. Lila Canyon and Little Park Wash, based on the size of the drainage area (greater than 1 sq. mi.), are defined by regulation as intermittent but have been shown to be intermittent by rule with ephemeral flow (see Appendix 7-7). Several smaller tributaries of these streams within the permit and adjacent areas are ephemeral by flow pattern and by rule.

Horse Canyon, Little Park and Lila Canyon flow during the spring snowmelt runoff period and also as a result of isolated summer thunderstorms. Due to the limited drainage area and elevation of Lila Canyon, the duration of the snowmelt flows is quite short and is limited to the very early spring. Flows in Horse Canyon, generally, are limited to the early spring period (Lines and Plantz, 1981). By mid to late spring, usually no flow is evident in Horse Canyon Creek, below the minesite or Lila Canyon.

Over the period of record, 1981 through present, there have been both wet and dry periods. From 1983 through 1984, the area had high precipitation. In the late 1990's through the present, a drought has been evident in the area. Over this period of record, the flows in the streams have increased and decreased based on the available water. Also, during both of these periods, flows in Horse Canyon Creek during the summer and fall are generally not evident below the mine site. Only flows from summer thunderstorms upstream of the site have resulted in flows below the mine. This indicates that while surface water resources may fluctuate, the fluctuations are not great enough to change the response of the stream to overcome the hydraulic and geologic characteristics of the area.

During most years, the snowmelt peak is the highest peak flow for the drainages. Under certain circumstances, when a significant summer thunderstorm occurs over the drainages, the runoff event can be quite large. In the area of the springs, there are sections with continuous flow, where the channel has cut into the perching layer of the spring. The flows from the springs continue a short distance downstream of the spring location; however, there is no base flow contribution within the channel itself. The only flow is a result of the spring discharge and this is absorbed by the channel fill indicating a losing stream reach. There are no indications that any other reaches of Lila Canyon or Little Park Wash are perennial. Since the spring of 2000, both areas have been observed numerous times (at least quarterly) and no flow has even been noted in either drainage. Normally, this would indicate an ephemeral drainage, however, since the drainage areas are greater than one square mile and exhibit no consistent flows, they are classified by regulation as intermittent.

The ephemeral nature of the streams make it difficult to document the high and low flow periods. Generally, the seasonal flow pattern for the drainages consists of dry channels until a thunderstorm or rapid snowmelt occurs. Then there is a short duration of flow within a portion of the channel. Following the passing of the storm or melting of the snow the runoff quickly decreases and the channel is again dry until the next event.

Such an event was documented in March 05 near the monitoring station L-11-G reported in the DOGM database 05/06/05. This was flow from a snowmelt event. An attempt was made to get to the monitoring point, but the access to the site was inaccessible due to deep snow across the road up Lila Canyon. Access was available only a short distance (couple of hundred feet above the Horse Canyon Access road). A water sample was taken at the upper most point that could be accessed. This was an area that typically would have been dry with no flow. The flow recorded was 7.5 gpm and a water quality sample was taken. The data are presented in the DOGM database.

A number of perched springs do exist in the tributaries of the upper reaches of the Little Park Wash drainage; however, the flows from the springs dry-up or infiltrate into the alluvial fill of the canyons within 50 to 200 feet of the source, before reaching the main drainage channel. The springs and seeps in the area have been sampled, as indicated in this application, as part of the baseline and spring/seep inventories. Therefore, they provide an estimate of the quality of the flow within the drainages.

Precipitation in the area generally consists of either high-intensity, localized thunderstorms or area wide, frontal storms. Table 7-1A presents rainfall-runoff model simulation results of both the 6-hour and 24-hour rainfall events of the drainages in the site area, to simulate each kind of storm. Appendix 7-10, Figure 1 presents the location of the drainages for the simulation results in Table 7-1A. Appendix 7-10 also presents the simulation calculation results. These peak flow results show that for short duration events with small return periods (5 years or less), there is little or no runoff from the watersheds. Additionally, due to the localized character of the thunderstorms, the storms affect only a part of the watershed and the limited runoff that does occur is lost to channel losses (infiltration, evaporation, transpiration) within the portion of the watershed that is not affected by the rainfall event. As the return period of the storm increases, storms have greater intensity and tend to cover larger areas, which likely affects most if not all of the watershed. Therefore, flows tend to increase. Intense rainfall may cause heavy flooding, but likely only affect small areas and do not result in large volumes of runoff.

For the long duration, frontal type storms, the entire watershed is covered for each event. The frontal precipitation events tend to produce only limited amounts of flow in the local ephemeral washes for the short return periods. With the increase in the return period, the flow events tend to be larger. This is due to the contribution from the entire watershed.

Each flow event in an ephemeral channel is separate and distinct. The stream flow is directly proportional to the amount of precipitation or snow-melt runoff, and the water quality varies greatly depending on the amount of flow. The duration of these runoff events is generally short. For thunderstorm events, the flow is generally less than a few hours. Duration of runoff from the frontal runoff events is moderate in length, generally on the order of 11 to 14 hours. Based on the end of rainfall from the watershed model simulations, the runoff would generally end within 3 to 5 hours. Therefore, if a sampler were not on-site during the event, it is unlikely that any flow would be observed.

Table 7-1A

PEAK FLOW SIMULATIONS OF UNDISTURBED DRAINAGES IN THE LILA CANYON MINE AREA

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
WS1.1	6 hr	0	0	1.39	5.54	9.98	17.18
	24 hr	0.65	3.22	9.31	22.68	39.50	59.77
WS1.2	6 hr	0	0	1.21	6.43	12.77	22.18
	24 hr	0.86	3.82	9.45	20.66	33.99	49.70
WS1 Total	6 hr	0	0	2.37	11.78	22.68	38.79
	24 hr	1.50	6.62	16.96	39.59	67.46	100.70
WS7 Total	6 hr	0	0	2.23	10.43	19.63	33.75
	24 hr	1.29	6.04	15.85	36.15	60.94	90.24

Table 7-1A

PEAK FLOW SIMULATIONS OF UNDISTURBED DRAINAGES
IN THE LILA CANYON MINE AREA

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
WS8 Total	6 hr	0	0	0.85	3.60	6.59	11.34
	24 hr	0.43	2.09	5.76	13.64	23.46	35.09
WS9 Total	6 hr	0	0	3.46	16.17	30.46	52.36
	24 hr	2.01	9.38	24.59	56.08	94.53	139.99

Table 7-1A

PEAK FLOW SIMULATIONS OF UNDISTURBED DRAINAGES
IN THE LILA CANYON MINE AREA

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
Little Park 6.1	6 hr	0	0	1.63	6.48	11.66	20.08
	24 hr	0.76	3.76	10.88	26.5	46.16	69.84
Little Park 6.2	6 hr	0	0	0.93	3.70	6.66	11.47
	24 hr	0.44	2.15	6.21	15.14	26.36	39.89
Little Park 6 Cumulative	6 hr	0	0	2.56	10.18	18.33	31.54
	24 hr	1.20	5.91	17.09	41.63	72.52	109.74
Little Park 6.3	6 hr	0	0	0.32	1.21	2.15	3.70
	24 hr	0.14	0.70	2.17	5.47	9.75	14.92
Little Park 5.1	6 hr	0	0	0.31	1.00	1.73	2.93
	24 hr	0.11	0.59	2.41	7.85	15.16	23.59
Little Park 5.2	6 hr	0	0	0.73	2.75	4.87	8.38
	24 hr	0.32	1.59	4.92	12.40	22.10	33.82
Little Park 5 Cumulative	6 hr	0	0	2.82	11.34	20.41	35.22
	24 hr	1.77	8.54	24.80	61.16	107.32	163.42
Little Park 4.1	6 hr	0	0	0.75	2.58	4.47	7.65
	24 hr	0.29	1.49	5.31	14.72	28.04	43.72
Little Park 4.2	6 hr	0	0	0.76	3.01	5.42	9.33
	24 hr	0.36	1.75	5.06	12.32	21.46	32.47
Little Park 6.4	6 hr	0	0	0.23	0.86	1.53	2.64
	24 hr	0.10	0.50	1.55	3.90	6.95	10.64

Table 7-1A

PEAK FLOW SIMULATIONS OF UNDISTURBED DRAINAGES
IN THE LILA CANYON MINE AREA

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
Little Park 6.5	6 hr	0	0	0.90	3.58	6.45	11.10
	24 hr	0.42	2.08	6.02	14.66	25.53	38.63
Little Park 4 Cumulative	6 hr	0	0	6.17	24.81	44.74	77.12
	24 hr	2.93	14.01	40.73	101.08	178.91	269.04
Little Park 6.6	6 hr	0	0	0.87	4.44	8.64	14.92
	24 hr	0.58	2.60	6.58	14.58	24.18	35.52
Little Park 3.1	6 hr	0	0	2.35	8.86	15.72	27.03
	24 hr	1.03	5.13	15.87	40.00	71.27	109.07
Little Park 3.2	6 hr	0	0	1.00	4.65	8.76	15.07
	24 hr	0.58	2.70	7.08	16.14	27.20	40.29
Little Park 3 Cumulative	6 hr	0	0	9.73	42.29	77.65	133.01
	24 hr	5.08	23.46	65.66	162.22	284.24	430.10
Little Park 6.7	6 hr	0	0	0.76	4.53	9.00	15.63
	24 hr	0.60	2.69	6.66	14.57	23.96	35.04
Little Park 2.1	6 hr	0	0	0	1.84	4.30	7.79
	24 hr	0.17	0.81	2.54	7.96	14.23	24.90
Little Park 2.2	6 hr	0	0	0.64	3.68	7.15	12.35
	24 hr	0.48	2.16	5.45	12.07	20.02	29.40

Table 7-1A

PEAK FLOW SIMULATIONS OF UNDISTURBED DRAINAGES
IN THE LILA CANYON MINE AREA

Watershed ID	Return Period	2yr (cfs)	5yr (cfs)	10yr (cfs)	25yr (cfs)	50yr (cfs)	100yr (cfs)
Little Park 2 Cumulative	6 hr	0	0	11.07	54.40	100.57	168.92
	24 hr	6.59	29.31	80.68	192.12	329.11	493.91
Little Park Total	6 hr	0	0	11.56	58.64	110.02	183.99
	24 hr	7.24	31.45	84.30	199.12	340.37	508.74

To determine the extent of the protection of these runoff waters, the downstream state appropriated waters were evaluated. As listed in Table 7-2 and shown on Plate 7-3, the downstream water rights are held by the BLM and consist of 91-2617, -2618, -2619, -2620, -2621, -2646, -2665, -4516, -4646, -4648, and -4649. As reported in Table 7-2, most of these rights have no flow and no use associated with them. According to the State Engineers web site, these rights have not yet been evaluated to determine if there is sufficient water to meet the right. Many of these rights are located on the stream and some are for stock ponds to be located off stream. However, in reviewing these locations, except for 91-2621, no stock ponds have been located in these areas. The BLM pond located at the location of water right 91-2621 had some improvement work conducted in 2004 (see Appendix 7-9). However, the BLM was not involved in the pond improvements. Recent site investigation shows that the diversion structure described in Appendix 7-9 has been breached and no flow now reaches the pond from Grassy Wash.

There are two water rights for isolated stock ponds in the head waters of Stinky Spring Canyon, 91-4648 for Dryden Reservoir located in the SE/4, SW/4, Section 14, T16S, R14E and 91-4649 for Sams Pond located in the NW/4, NE/4, Section 23, T16S, R14E (see Plates 7-1 and 7-3). Both of the water rights are owned by the BLM and have a maximum capacity of 3 ac-ft. No records have been found that these ponds were constructed. Based on the maximum capacity of the ponds, it is expected that these ponds would be about one half acre in size, assuming a depth of 5 feet. Field inspection of the quarter sections found no ponds along the ephemeral drainages and review of aerial photos of the area also did not reveal any ponds in the area. Based on the locations for the water rights, the area for water right 91-4648 is shown in a photograph presented in Attachment 1 of Appendix 7-7 (Photo 93 - Page 28). As can be seen, there is no stock pond in this area. The area for water right 91-4649 is shown in photographs taken in the area (see Figure 7-5) indicated in the water right of the pond. No pond has been found. The only thing found in the designated area is an area of grass in the pinyon juniper.

Based on water rights flow values and the lack of a specified use, it is assumed that the State Engineer and the BLM had planned to develop range improvements in the area, but the lack of water made this effort unsuccessful. Given the lack of use for these downstream channels, it does not appear that a significant concern exists for the downstream waters.

Surface waters in this part of the Book Cliffs drain to the Price River. The Price River flows to the Green River which, in turn, flows to the Colorado River. It is anticipated that only during extremely long duration, high-intensity thunderstorms that flow from the ephemeral and intermittent drainages within the permit area would reach the Price River. Due to the length of channel and the limited volume of runoff, the majority of flow is lost to channel losses, as indicated in Appendix 7-9.

Lines and Plantz (1981, p. 33) conducted three seepage surveys of Horse Canyon Creek in 1978 and 1979. The results of the surveys show no consistent trends through time. Mine discharges created difficulties in interpretation of the data because there was no indication of whether the mine was or was not discharging water at the time of the surveys. However, Horse Canyon Creek below the mine is a losing stream, due to the visual observation of low flows decreasing downstream of the mine (professional observations, Thomas Suchoski, 1979-1980 & 1984-86). Flow in the channel adjacent to the mine facility entry portal on several occasions during mine inspections during the spring period were approximately 4 to 6 inches deep, with a flow width of 15 to 20 feet. Downstream of the mine in the area of the roadside refuse pile, the flow would be 2 to 3 inches deep with a flow width of 10 to 12 feet. Channel slopes in both areas were similar. No diversions are present along this reach of the channel to reduce the flow. Therefore, the channel flow decrease is the result of infiltration and evaporation of the water within the channel.

The Lila Canyon drainage is normally dry, flowing only in response to precipitation runoff or rapid snowmelt. The mine facilities will be located in the Right Fork of Lila Canyon.

In January 2004, an assessment of the geomorphic character of the Lila Canyon channel, downstream of the proposed mine site, was conducted to address

DOGM comments. A series of channel cross-section measurements were taken and the bed and bank materials visually observed. During this evaluation, it was discovered that a diversion structure had been installed just above the confluence of the Right Fork of Lila Canyon and Grassy Wash (see Appendix 7-9 and Figure 7-3). This diversion structure diverted all flow from the drainage and conveyed it by diversion channel to a stock pond located in the SW/4, SW/4 of Section 28, T. 16 S., R. 14 E. Subsequently, it was thought that the improvements were part of a BLM range improvement project. This structure significantly modified the drainage pattern for this area. Flows that previously would have flowed into Grassy Wash would now be detained in the stock pond. However, in discussions with BLM personnel, it was discovered that the BLM was not involved in the pond improvements. Recent site investigation shows that the diversion structure described in Appendix 7-9 has been breached and no flow now reaches the pond from Grassy Wash.

The closest perennial stream to the permit area is Range Creek. The drainage is located approximately <u>6 miles</u> east of the proposed Lila Canyon permit area boundary (see Plate 7-1a).

Range Creek is in a broad, south-southeast oriented drainage that has been eroded into the Roan Cliffs. A western extension of the Roan Cliffs (Patmos Ridge) lies between Range Creek and the Book Cliffs. The proposed Lila Canyon operation is on the west side of Patmos Ridge. The Colton Formation is exposed at the surface from Patmos Ridge east to the main body of the Roan Cliffs, and between these two escarpments Range Creek has eroded into but not through the Colton Formation. Approximately eleven miles southeast of the permit area, just upstream of Turtle Canyon, Range Creek has eroded through the Colton, Flagstaff, and North Horn Formations, but it reaches the Green River without having eroded through the Upper Price River Formation. The nearest Blackhawk outcrop is 10 miles further south, along the Price River.

Argument has been made that Range Creek receives recharge from a regional aquifer which is likely from the lower saturated zone that the Lila Canyon Mine will be mining or that the overlying perched upper zone might be drained by the mining activities and affect the flows contributing to and in Range Creek.

To address these concerns, the following issues were evaluated. An evaluation of the elevation difference between the saturated ground-water zone in the Blackhawk Formation and stream flows in the Range Creek drainage was conducted, especially for the reaches nearest the permit area. Also, the thickness and composition of the strata between the coal seam and the creek was conducted. Further, the potential for diminishment of spring and tributary flows to the Range Creek drainage resulting from subsidence impacts within the recharge area to the overlying strata was evaluated.

If the deeper ground water in the Blackhawk Formation were to flow following either the gradient indicated by the piezometers (see Figure 7-1) or geologic dip (see Plate 7-1B), the water would flow well below Range Creek (800 to 1,200 feet) in the reaches nearest the Lila Canyon Mine and for many miles downstream.

Additionally, the thick section of strata between Range Creek and the Blackhawk Formation would impede hydraulic interaction between any deep ground water and the surface (Plates 7-1A and 7-1B). It is estimated that the vertical separation between the Blackhawk and Range Creek at the base of the Colton would be about 1,200 feet.

A review of U.S. Geological Professional Paper by D.J. Fisher, C.E. Reeside and J.B. Erdman, 1960, **Cretaceous and Tertiary Formation of the Book Cliffs, Carbon and Emery Counties, Utah,** which evaluates the composite stratigraphy in the Horse Canyon area, was conducted. The lithology descriptions were reviewed and a total of the percentage of shale, siltstone and mudstone (less permeable layers), for each strata identified by the authors, was generated to get an idea of the ability of each strata to restrict flow throughout the stratigraphic column.

Colton Formation		
Upper Sandstone Unit	1,300 ft.	
% Shale		23.1
Shale Unit	960 ft.	
% Mudstone		82.9
Lower Sandstone Unit	1,128 ft.	
% Shale and Mudstone		34.8
North Horn–Flagstaff, Undifferentiated		
Shale beds	237 ft.	
Mudstone	181 ft.	
Limestone	21 ft.	
Siltstone	25 ft.	
Clay	7 ft.	
Sandstone beds	99 ft.	
%Shale, Clay, Siltstone, and Mudstone		79.0
Price River Formation		
Upper Unit	299 ft.	

% Shale		43.8
Lower Unit	234 ft.	
% Shale and Siltstone		43.8
Castlegate Sandstone	160 ft.	
% Shales, Clays, Siltstones or Mudstones		0
Blackhawk Formation		
Upper Shale Unit	170 ft.	
Middle Sandstone Unit	0 ft.	
Middle Shale Unit	102 ft.	
Lower Sandstone Unit	200 ft.	
% Shale		52.5

Based on the stratigraphic column in the area, the overall percentage of less permeable strata is 47 percent. Looking at the distribution of the less permeable strata, the majority is in the upper lithographic units. The Colton and North Horn-Flagstaff contain about 1940 feet of less permeable units, while the Price River and Blackhawk contain about 480 feet. Therefore, there is little potential for water to move vertically between the upper and lower zones. The main direction of water movement will be horizontally within the strata.

Further, the elevation of Range Creek in the area of concern ranges from 6890 to 5740 feet (see Plate 7-1A). The coal seam exposure along the Book Cliffs ranges from 5,500 to 6,000 feet. Therefore, for water to flow from the coal seam to Range Creek the flow would need to overcome a hydraulic head difference of 200 plus feet, just based on the initial elevation and not accounting for dip of the formations. There is insufficient head and no source of water to provide the driving head for such conditions.

In regard to subsidence affecting the potential recharge to the springs and tributaries to Range Creek, as described in Chapter 5, Section 525, the subsidence limits from the proposed mining are required to be limited to the area of the permit boundary. Therefore, the recharge area to Range Creek that the mine might affect is limited to that portion of the recharge area within the permit boundary.

To determine the recharge area to Range Creek, a review of the relationship of the proposed permit area, location of Range Creek and the geology in the area, as shown on Plate 7-1A, in the reach nearest to the proposed mine, was conducted. As is evident on Plate 7-1A, the Little Park drainage has eroded through the Colton and North Horn Formations and into the Price River Formation, while the Range Creek drainage has not eroded through the Colton

Formation. Based on this and the previous discussion of the high percentage of low permeable strata within the Lower Colton and North Horn-Flagstaff formations, there is limited potential for recharge to the springs and tributaries from areas below the bottom of the Colton Formation. Figure 7-3 presents a representation of the likely characterization of the method of recharge to these springs. The potential impact area from the mine is, therefore, that portion of the permit area that is east of the Horse Canyon and Little Park drainages which is above the Colton - North Horn-Flagstaff contact within the area of maximum subsidence.

Based on a projection of the direction of dip (N68°E), the recharge area of the Range Creek drainage that might be affected by the mine would be from just north of Little Horse Canyon south to Cherry Meadow Canyon. Figure 7-4 presents a localized view of this area with recharge potential along the west side of the Range Creek drainage. The total recharge area to this portion of the Range Creek drainage is approximately 18,150 acres.

Based on a review of Figure 7-4, the portion of the permit boundary that meets the potential impact area criteria is approximately 183 acres. Therefore, the percentage of the recharge area that might be intercepted by catastrophic subsidence is 1.0 percent. As catastrophic subsidence is unlikely due to the cover over the coal seam for most of this area (2,000ft +) (see Figure 7-4), this percentage is conservatively high. Such a small percentage would not be measurable within the Range Creek drainage.

If such an occurrence were to happen, based on the hydraulic conductivity (0.1gpd/ft^2) and porosity (0.25) of the formation and the anticipated gradient (0.1ft/ft), the average linear velocity of flow through the formation would be about 0.006ft/day. This results in an estimated duration, for the reduced recharge to move laterally through the Colton Formation and reach the Range Creek drainage, to be about 8,700 to 11,300 years.

As a result of the five to six miles horizontal distance from proposed permit area to Range Creek (see Plate 7-1a) and the isolating effects of the over 1,000 feet of low-permeability, isolating strata between the coal seam and the creek elevation (see Plate 7-1B and Table above) and the limited potential impact of subsidence damage to the recharge area, it is not likely that the Lila Canyon Mine will adversely effect Range Creek. Due to these conditions, no baseline or other sampling has been gathered nor is anticipated on Range Creek.

Additional concerns have been raised regarding the potential impact that water extracted from the Blackhawk Formation as a result of the mining activities would have on the downstream drainages, specifically the Price and Green

Rivers. Initial evaluation indicates that the distance within the Blackhawk Formation between the mine and the Price River is over 12 miles. This distance alone would preclude any significant impact.

As further evidence, as discussed in Appendix 7-3, it is difficult to determine the amount of water that will be extracted by the mining activities. For design purposes, DOGM has required that a value of 500 gpm be used. This is thought to be very conservative. If this volume were extracted, the yearly total would be about 800 ac-ft per year. As there are no significant springs that discharge from the Blackhawk Formation, the loss of this flow would be minimal. Also, as discussed in Appendix 7-3, the addition or loss of this flow would result in a 0.9% flow change to the Price River and a 0.02% flow change to the Green River. In both cases, this flow change would be less than could be measured by standard methods.

The Horse Canyon drainage is monitored in accordance with the approved monitoring plan for the permit. There has been only one sample taken in the Lila Canyon and no samples taken in Little Park Wash because only limited flow has been observed during the monitoring activities. Factors that contribute to the lack of data are: accessibility to the sites during the winter period and immediately after summer rain storm events is generally not possible, due to safety issues and a physical lack of flow. Concerns have been raised that evidence of flow has been seen in the drainages over the course of the year, therefore, why hasn't a water quality sample been collected. The following sections address the concerns of access and safety, physical lack of flow, and monitoring methods.

Access and Safety. Safety issues have hampered field work on several projects in the area. When the soils in the area get wet from a light rain, that would not generate a flow event, they become very slick and pose access and safety issues. During the IPA drilling, EarthFax had significant difficulty in getting equipment and vehicles up and down the access road following several small rain storms. In one case, they had one of their vehicles slide into the embankment rocks along the Horse Canyon access road (drop in the area was about 400 feet).

In the conditions of heavier rains, access during rainstorms through the channels in the area is dangerous. During the avian study for the Westridge mine, Mel Coonrod (EIS) and Frank Howe (DWR) were caught in a channel during a rainstorm and lost their vehicle to flooding. This occurred on Nine Mile Creek at the Dry Canyon crossing in March or April of 2000. Conditions in this drainages are similar to drainages within the Lila Canyon Permit Area.

During winter and early spring periods, there have been times when the access road has been blocked with several feet of snow making access with the field equipment impossible.

UAE's position is that collection of environmental data is not worth of the loss of life or limb. Therefore, when the conditions are unsafe, the site is labeled inaccessible. At all other times, the sites are visited and if no flow is encountered it is reported as such.

Physical Lack of Flow. The lack of flow data in the sampling effort is not a failure of the sampling effort. The lack of flow at these sample sites is data which documents the normal conditions in the site area. If the streams were flowing 50 percent of the time, it is likely that the sampling efforts would encounter flow on an infrequent basis. However, if the flow for the short return periods is extremely small or none existence, it will be difficult to obtain and provide samples of these events. This lack of flow shows that the drainages do not have a base flow component and there is no regional aquifer discharging to the deeply incised canyons and drainages in the area. The sequence of sampling efforts have demonstrated further, that there are no long-term flow events occurring in the mine permit area or adjacent areas. Also, spring photographs show disturbances in the stream channels from the previous fall period sampling efforts, indicating that for some years no flow occurred from the fall to spring measurement events. Additionally, the peak flow simulation results presented in Table 7-1A show that for small return periods, 2 to 5 year events, runoff flows are not expected and that the duration of any flow events would be of extremely limited duration.

Therefore, a pattern has been identified of a set of drainages that only flow in direct response to precipitation or rapid snow melt. The flow events are localized, sporadic events with no consistent sequence and timing and are extremely limited in duration. For ephemeral drainages in the area, these are the variations and distributions in flow that can be expected and are seen at other mines. Under the definitions in the rules, the seasonal variation would then be the isolated snowmelt in various reaches of the channels in the spring period, and the isolated peak flow from a thunder storm that would have enough intensity to result in a runoff event. Based on the runoff simulations in Table 7-1A, for the larger precipitation events, the flows can be significant.

U.S. Steel conducted water quality monitoring of the Horse Canyon drainage. These monitoring efforts were conducted prior to the development of DOGM's present Water Monitoring Guidelines, and as a result the data is quite limited. The most recent results of these water monitoring efforts are presented in Appendix 7-2 and historic results are included in the DOGM electronic database.

The data collected from Horse Canyon follows the same pattern documented by Waddell, et.al. (1986). The pattern shows that the TDS concentrations for surface waters on the lower Blackhawk and out onto the Mancos Shale range from 1000 mg/l and increase to 2,000 to 2,500 mg/l. Additionally, the highest concentrations of suspended sediment will occur during high-intensity runoff from thunderstorms, and the lowest concentrations will occur during low flow or snow melt events.

Therefore, because of the similarity of the water quality data, the water quality expected from the drainages in the area of the proposed mine will be similar to the water quality found in the Horse Canyon drainage.

Monitoring Methods. Monitoring efforts did not include remote or automatic sampling efforts because of inherent problems attempting to implement these methods for this application. It has been suggested that crest-staff gauges, single-stage samplers, ISCO instruments, etc. could be used to collect samples. These are methods that the USGS uses for developed remote sampling sites. However, none of the UEI sampling sites are developed. In the case of crest gauges, for these methods to be reliable and feasible, the sites need to be developed with concrete or bedrock lined channel sections. For the channel configurations at the UEI sites, the channel bottoms generally consist of movable beds. These are channels that change configuration from storm to storm. As a result of channel erosion and deposition, the stage discharge relationship of the channel changes with each storm event. Therefore, while the crest gauge would indicate that a flow event may have occurred, the ability to determine what the flow rate was is greatly compromised. To be able to overcome this, it would be necessary to construct lined channel sections in remote channel areas. In some cases, this would require the construction of access ways and cement trucks to haul in the materials necessary. This would likely cause more damage than it is worth.

Single stage and automatic samplers have problems with holding time on many water samples being exceeded, routine clogging of the inlets to the sampler, and acceptability or reliability of the data. Holding time exceedence would occur when a storm event occurred immediately after a prior sampling visit and resulted in a sample being collected. As a result, the sample would remain in an unpreserved and unrefrigerated state for the duration of the period until the site was next visited. In the hot summer conditions, common in the area, the water quality of unpreserved and unrefrigerated samples would not be representative of the water in the drainage during the flow event. Changes to water quality parameters would be expected with changes in temperature of the sample, concentration due to evaporation of the sample, and extended contact of the water with the sediment collected in the sample bottle. Therefore, for the majority of parameters in the monitoring guidance list, the water quality data would not be usable for determining the baseline or impact conditions.

Maintenance problems have been common problems with the use of remote samplers. Generally, these samplers work fairly well in perennial sampling environments. However, in ephemeral environments where the flows tend to be "flashy" - short duration events which carry a heavy sediment and debris load, these samplers encounter significant problems with plugging of the inlets or sampler damage or destruction.

The use of stage or automatic samplers on ephemeral streams does not meet the USGS sampling protocols and are not a depth integrated sample. According to the Shelton (1994), there are no protocols for adequately sampling an ephemeral stream and ephemeral streams are not included in the national water-quality assessment program. Australian water quality monitoring guidelines suggest that automatic samplers are not appropriate for sampling parameters that change with time (A-NZECC, 2000). ADOT (2005) removed all automatic samplers from there monitoring program. Only grab samples are allowed and ADOT will not accept any data collected by any automatic samplers. Recent information provided to ADOT indicates that automatic samplers are unreliable and impractical in arid climate conditions in Arizona. As the conditions in the arid climate in Southeastern Utah are similar to the Arizona conditions, similar difficulties and problems will be encountered and the data will have the same difficulties.

Several samplers were installed as apart of the Westridge Mine sampling efforts. The samplers have problems with plugging and malfunctions on a regular basis and need constant maintenance. They are still in use, because they were required, however, the data are of limited value (Karla Knoop, personal communication, 2006). Single stage and automatic samplers were also installed as part of the Smoky Hollow baseline data collection efforts. Similar maintenance and malfunction problems were identified as part of the Smoky Hollow sampling efforts (Richard White, personal communication, 2006).

Radio Frequency telemetry (RF) sensing equipment has also been considered. However, as most of the monitoring sensors require line of sight and these sites are in remote, incised canyons or drainages, that was not considered a viable option.

As a result of these difficulties, it was determined that these methods would not provide any better data than was already being collected. The concerns with what conclusions erroneous or questionable data would generate versus limited good data lead to the decision that these methods would not be used.

724.300 Geologic Information Detailed geologic information of the permit and adjacent areas is included in Section 600, with specific strata analyses, as required, in Section 624.

724.310 Probable Hydrologic Consequences. The geologic data indicate that no toxic- or acid-forming materials are known to exist in the coal or rock strata immediately below or above the seam (see Section 624.300). The probable hydrologic consequences of the proposed operation will be discussed in Section 728 and Appendix 7-3 of this application.

724.320 Feasibility of Reclamation. The geologic data in Section 600 provides sufficient detail to allow: the evaluation of whether toxic- or acid-forming materials are expected to be encountered in mining; subsidence impacts; whether surface disturbed areas are designed to be constructed in a manner that will allow for reclamation to approximate original contour; and whether the operation plans have been design to ensure that material damage to the hydrologic balance does not occur outside of the permit area. These issues are evaluated in the R645 rules and discussed in Section 728 of this application.

724.400 Climatological Information

724.410 Climatological Factors

724.411 Precipitation The closest weather recording station to the Lila Canyon Mine is located at Sunnyside, Utah. Based on the relatively close proximity and similar locations (west exposure of the Book Cliffs) the data from this station is representative of the type, intensity and duration of the precipitation at the site area and will be used to verify precipitation amounts and other weather conditions for the Lila Canyon Mine.

Precipitation data from the Sunnyside station has been gathered from 1971 to 2005, showing an average annual precipitation of 14.74 inches. The information was downloaded from the Western Regional Climate Center, as shown on Table 7-1B. The distribution of precipitation shows that September and October average the highest totals. Based on a 1-day precipitation event or less, the probability of precipitation is generally less than 20 percent for an event with 0.01" and less than 5 percent for an event with greater than 0.50" (see Table 7-1C). This indicates that the precipitation events are generally light and consist of infrequent small storms.

A rain gauge will be installed at the site, once construction and operations start, to comply with the reporting requirements of the air quality permit.

724.412 Winds. The average direction of the prevailing winds is West to East, and the average velocity is 2.74 knots.

Table 7-1B

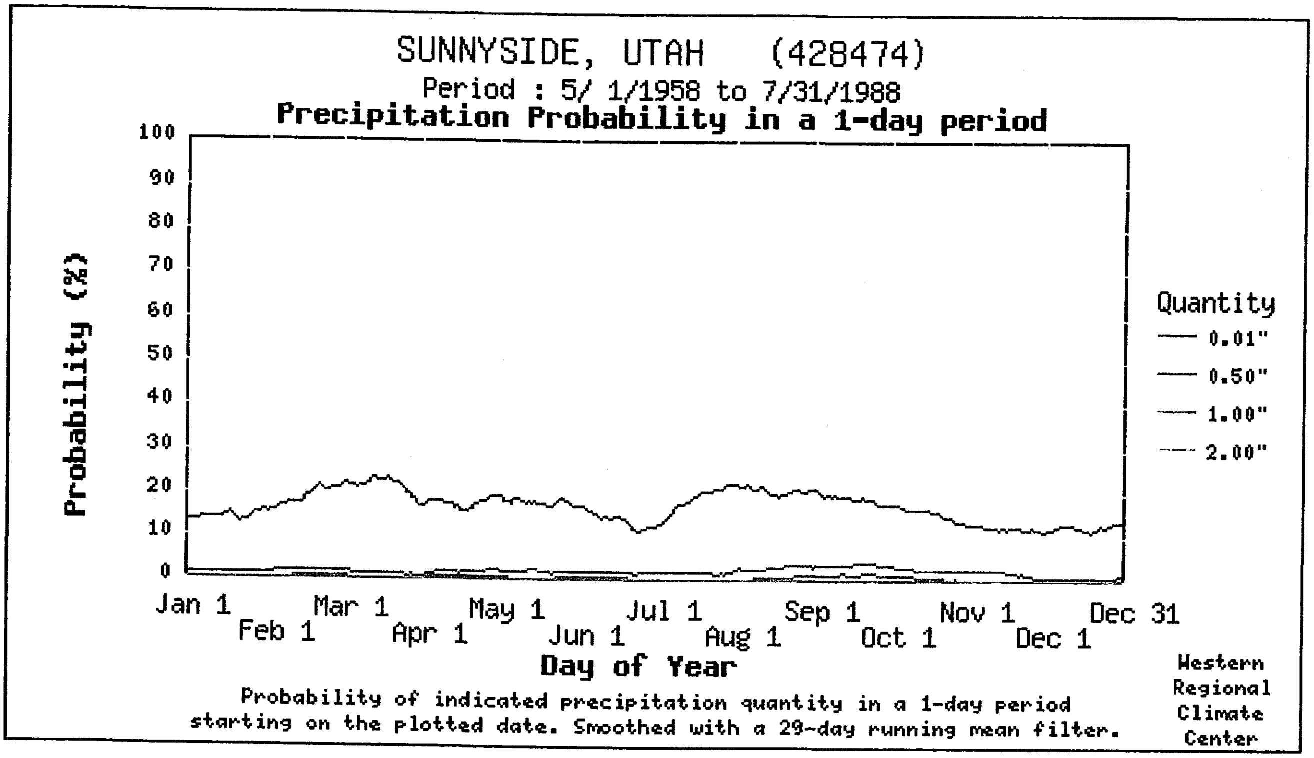
Sunnyside, Utah (428474)
Period of Record Monthly Climate Summary

Period of Record: 1971 - 2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Average Max. Temp(F)	33.7	38.4	44.1	54.0	63.5	76.2	82.4	80.3	71.3	58.3	42.8	34.9	56.8
Average Min. Temp(F)	13.9	17.5	21.8	30.0	38.3	47.2	53.6	52.2	44.7	34.6	22.8	15.3	32.8
Average Total Precip (in.)	0.80	1.01	1.30	1.22	1.22	0.85	1.46	1.50	1.80	1.67	1.14	0.78	14.74

Unofficial values based on averages/sums of smoothed daily data, Information is computed from available daily data during the 1971-2000 period. Smoothing, missing data and observation-time changes may cause these 1971-2000 values to differ from official NCDC values. This table is presented for use at locations that don't have official NCDC data. No adjustments are made for missing data or time of observation. Check NCDC normals table for official data.

TABLE 7-1C



724.413 Temperature. Mean temperatures in the proposed mine area range from a high of 58.0 degrees F to a low of 33.4 degrees F. See Table 7-1B.

724.420 Additional Data. Additional data will be supplied if requested by the Division to ensure compliance with the requirements of R645-301 and R645-302.

724.500 Supplemental Information N/A - The determination of the PHC in Section 728 does not indicate that adverse impacts on or off the proposed permit area may occur to the hydrologic balance, or that acid-forming or toxic-forming material is present that may result in the contamination of ground-water or surface-water supplies.

724.700 Valley/Stream N/A - The proposed plan does not include mining or reclamation operations within a valley holding a stream or in a location where the permit area or adjacent area includes a stream which meets the requirements of R645-302-320.

725. Baseline Cumulative Impact Area Information

725.100 Hydrologic and Geologic Information Hydrologic and geologic information for the mine area is provided in Sections 600, 724 and in the PHC Determination in Appendix 7-3. This information includes the available information gathered by the applicant. Additional information is available for the areas adjacent to the proposed mining and adjacent areas from state and federal agencies.

725.200 Other Data Sources As indicated above, additional information is available for the cumulative impact area. In addition to the base line data for the proposed mining, additional pertinent hydrologic data is available from adjacent mines and permits and government reports.

725.300 Available Data Necessary hydrologic and geologic information is assumed to be available to the Division in this P.A.P.

726. Modeling Where ever possible actual surface and ground water information is supplied in this application. However, the following models were used to supplement the data.

Storm 6.2, a program to calculate runoff flows was used to calculate runoff from some disturbed area drainage areas.

Hydroflow Hydrograph program by Intelisolve was used to simulate the runoff and routing from the undisturbed drainages above the proposed mine. As discussed in Section 724.200 of the MRP, the flow simulations provide an understanding of the types and kinds of flow responses that can be expected from the watersheds of the proposed mine area.

A simulation of transmission losses to determine potential impacts from mine water discharge to the Price River and fishery was completed using a spreadsheet based on the NRCS channel loss evaluation.

727. Alternate Water Source Information A search was conducted of the State of Utah Water Rights files for all rights occurring within, and adjacent to, the permit area for a distance of one mile. The location of those rights are shown on Plate 7-3, based on the location provided for the water right. A description of each of the rights, including the name of the water right owner, point of diversion, source of the water, along with the allotted flow and the designated use of the water is tabulated in Table 7-2. Due to the limited volume of water available, the condition of most of the spring and stock pond facilities is very poor. Based on the water rights, for the area of the mine, the use is limited to stockwatering of less than 250 animal units.

Table 7-2

LILA CANYON MINE AREA
Water Rights

Water Right/Owner	cfs	gpm	ac.ft.	Source	Use	Point of Diversion
91-557 Eardley, Joseph K.	0	-	0	So. Fork Horse Canyon Creek	Stockwatering	SW 34, T. 15 S, R. 14 E.
91-557 Eardley Joseph K.	0	-	0	So. Fork Horse Canyon Creek	Stockwatering	NE 34, T. 15 S, R. 14 E.
91-1903 State of Utah	0.08	36	0	Spring	Stockwatering	SE 35, T. 15 S, R. 14 E.
*91-148 IPA	0.30	135	0	U. G. Tunnel	Other	NW 3, T. 16 S., R. 14 E.
*91-149 IPA	0.10	45	0	U. G. Tunnel	Other	NW 3, T. 16 S., R. 14 E.
*91-150 IPA	0.10	45	0	U. G. Tunnel	Other	NW 3, T. 16 S., R. 14 E.
*91-4959 CEUF	0.00	-	5.00	Redden Spring	Mining	NE 3, T. 16 S., R. 14 E.
91-2616 BLM	0	-	0	Stream	Stockwatering	NW 3, T. 16 S., R. 14 E.
*91-183 CEUF	0.8	359	0	Horse Canyon Creek	Domestic, Other	SE 1/4 3, T.. 16 S., R. 14 E.
91-185 Minerals Devel. Co.	0.0190	9	0	Well	Domestic, Other	NW 9, T. 16 S., R. 14 E.
91-618 Mont Blackburn	0.0110	5	0	Mont Spring	Stockwatering	NE 11, T. 16 S., R. 14 E.
91-2615 BLM	0	-	0	Stream	Stockwatering	NW 10, T. 16 S., R. 14 E.
91-617 Mont Blackburn	0.0110	5	0	Leslie Spring	Stockwatering	NW 11, T. 16 S., R. 14 E.

Table 7-2

LILA CANYON MINE AREA
Water Rights

Water Right/Owner	cfs	gpm	ac.ft.	Source	Use	Point of Diversion
91-4650 BLM	0	-	0	Tributary to Flat Wash	Stockwatering, Other	SW 9, T. 16 S., R. 14 E.
*91-399 IPA	0.050	22	0	Unnamed Spring	Mining, Other	SE 12, T. 16 S., R. 14 E.
91-2537 BLM	0.0120	5	0	Spring	Stockwatering	SE 12, T. 16 S., R. 14 E.
91-2521 BLM	0.0110	5	0	Cottonwood Spring	Stockwatering	NE 13, T. 16 S., R. 14 E.
91-4648 BLM	0.00	-	0	Unnamed Wash	Stockwatering, Other	SW 14, T. 16 S., R. 14 E.
91-4649 BLM	0	-	0	Unnamed Wash	Stockwatering, Other	NE 23, T. 16 S., R. 14 E.
*91-810 IPA	0.050	22	0	Unnamed Spring	Mining, Other	SE 24, T. 16 S., R. 14 E.
91-2517 BLM	0.0110	5	0	Pine Spring	Stockwatering	SE 24, T. 16 S., R. 14 E.
91-2618 BLM	0	-	0	Stream	Stockwatering	NW 27, T. 16 S., R. 14 E.
91-2619 BLM	0	-	0	Stream	Stockwatering	SE 28, T. 16 S., R. 14 E.
91-2620 BLM	0	-	0	Stream	Stockwatering	SE 28, T. 16 S., R. 14 E.
91-2621 BLM	0	-	0	Stream	Stockwatering	SW 28, T. 16 S., R. 14 E.
91-2617 BLM	0	-	0	Stream	Stockwatering	SE 27, T. 16 S., R. 14 E.
91-4646 BLM	0	-	0	Wash	Stockwatering, Other	SW 33, T. 16 S., R. 14 E.
91-2518 BLM	0.110	5	0	Williams Spring	Stockwatering	SE 8, T. 17 S., R. 15 E.

Table 7-2

LILA CANYON MINE AREA
Water Rights

Water Right/Owner	cfs	gpm	ac.ft.	Source	Use	Point of Diversion
91-4516 BLM	0	-	0	Little Park Wash	Stockwatering, Other	SW 7, T. 17 S., R. 15 E.
91-4705 BLM	0	-	0	Bear Canyon	Stockwatering, Other	NW 7, T. 16 S., R. 15 E.
91-4621 BLM	0.0150	7	0	Kenna Spring	Stockwatering, Other	NE 8, T. 16 S., R. 15 E.
91-4701 BLM	0	--	0	Nelson Canyon	Stockwatering, Other	NW 17, T. 16 S., R. 15 E.
91-2519 BLM	0.0110	5	0	Unnamed Spring	Stockwatering, Other	SE 18, T. 16 S., R. 15 E.
*91-808 IPA	0.050	22	0	Unnamed Spring	Mining, Other	SW 18, T. 16 S., R. 15 E.
91-2538 State of Utah	0.0120	5	0	Unnamed Spring	Stockwatering	SW 18, T. 16 S., R. 15 E.
91-4701 BLM	0	-	0	Nelson Canyon	Stockwatering, Other	SE 17, T. 16 S., R. 15 E.
91-2539 BLM	0.0120	5	0	Pine Spring	Stockwatering	SW 19, T. 16 S., R. 15 E.
91-4703 BLM	0	-	0	Nelson Canyon	Stockwatering, Other	NW 21, T. 16 S., R. 15 E.
91-4703 BLM	0	-	0	Trib. to Nelson	Stockwatering, Other	NE 29, T. 16 S., R. 15 E.
91-4381 State of Utah	0.0150	7	0	Spring	Stockwatering,	NW 32, T. 16 S., R. 15 E.
91-2520 BLM	0.0110	5	0	Unnamed Spring	Stockwatering	NW 32, T. 16 S., R. 15 E.
*91-809 IPA	0.0500	22	0	Unnamed Spring	Mining, Other	SE 31, T. 16 S., R. 15 E.
91-2535 BLM	0.0120	5	0	Unnamed Spring	Stockwatering	SE 31, T. 16 S., R. 15 E.

Table 7-2

LILA CANYON MINE AREA
Water Rights

Water Right/Owner	cfs	gpm	ac.ft.	Source	Use	Point of Diversion
91-2646 (Cove #1)	0	0	0	Wash	Stock Watering	NE 06, T.16S., R. 14E.
91-2665 ((Big Pond)	0	0	0	Wash	Stock Watering	NE4 05, T.17S., R. 14E.

Any State-Appropriated water supply that may be damaged by mining operations will either be repaired or replaced. As soon as practical, after proof of damage by mining in Lila Canyon, of any State-Appropriated water supply, UEI will replace the water. Water replacement may include sealing surface fractures, piping, trucking water, transferring water rights, or construction of wells. The preferable method of replacement will be sealing of surface fractures effecting the water supply. As a last resort UEI will replace the water by transferring water rights or construction of wells.

As noted in the table, the majority of rights are owned by UEI for industrial use. Other rights owned by the B.L.M. or individuals are primarily for stockwatering.

UEI owns the rights to approximately 1.50 cfs in this area. Although the PHC (Appendix 7-3) indicates little, if any, adverse effects on water resources resulting from the operation, if such effects should become evident, lost water sources would be replaced from the rights owned by the company.

728. Probable Hydrologic Consequences (PHC) Determination

728.100 PHC The Probable Hydrologic Consequences (PHC) Determination is provided as a separate document in Appendix 7-3. This determination indicates minimal (or no) negative impacts of the mining or reclamation operation on the quality and quantity of surface and ground water under seasonal flow conditions for the proposed permit and adjacent areas.

728.200 Basis for Determination The PHC is based on baseline hydrologic, geologic and other information such as public records and adjacent mine plan data statistically representative of the site (see Appendix 7-3).

With underground mining, there always exists a potential for impacting surface or ground water resources; however, as indicated in Section 525, subsidence effects are expected to be minimal due to the amount of cover and massive rock stratas between the mining and the surface. Effects on underground water are also expected to be minimal, since this water is not presently issuing to the surface, and any necessary discharges of the water would be in accordance with U.P.D.E.S. requirements.

Water in this area is primarily used for stock or wildlife watering. Any impacts to the small surface springs or seeps as a result of mining would likely be offset by the emergence of new seeps or springs due to fracturing, mine water discharge or replacement of water rights as described under Sections 525, and 731.800.

728.300 Findings

728.310 Adverse Impacts. Potential adverse impacts of the operation on the hydrologic balance include:

(1) Increased sediment loading;

(2) Diminution or interruption of water supplies on water rights;

(3) Discharge (pumping) of contaminated ground water;

(4) Erosion and streamflow alteration;

(5) Deterioration of water quality.

Each of the above potential impacts has been evaluated in the PHC (Appendix 7-3). Based on information provided in this plan to mitigate or otherwise control these impacts, the Probable Hydrologic Consequences determination is that of minimal (or no) negative impacts. (see Appendix 7-3)

728.320 Acid/Toxic Forming Materials (see Appendix 7-3)

728.330 Impacts On:

728.331 Sediment Yield (see Appendix 7-3)

728.332 Water Quality Parameters (see Appendix 7-3)

728.333 Flooding and Streamflow Alteration In the event that sufficient volumes of water are encountered underground that necessitate pumping, the applicant will take the following steps:

(1) Water will be held in sumps as long as possible to promote settling;

(2) Water will be sampled prior to discharge to ensure compliance with UPDES standards;

(3) Prior to mining receiving channel morphology parameters and erosion impacts will be evaluated prior to discharging to any drainage and at least quarterly during pumping to determine what, if any, streamflow alteration is occurring;

(4) If adverse impacts to the receiving stream are noted, steps will be taken, with Division input and approval, to minimize or eliminate those impacts.

(Also see Appendix 7-3)

728.334 Water Availability (see Appendix 7-3)

728.335 Other Characteristics (see Appendix 7-3)

728.340 Surface Mining Activity N/A - Underground Mine

728.400 Permit Revision To be reviewed by the Division.

729. Cumulative Hydrologic Impact Assessment (CHIA)

729.100 CHIA Assessment provided by Division.

729.200 Permit Revision To be reviewed by the Division.

730. Operation Plan

731. General Requirements This will be an underground mine with approximately 42.6 acres of surface disturbance for mine site facilities and roads. Runoff from the disturbed minesite area is proposed to be controlled by a system of ditches and culverts which will convey all disturbed area runoff to a sediment pond for final treatment prior to discharge.

This permit application includes a plan, with maps and descriptions, indicating how the relevant requirements of R645-301-730, R645-301-740, R645-301-750 and R645-301-760 will be met. Each of these sections are addressed in this Chapter, along with relevant Maps and Appendices.

731.100 Hydrologic-Balance Protection

731.110 Ground-Water Protection In order to protect the hydrologic balance, coal mining and reclamation operations will be conducted according to the plan approved under R645-301-731 and the following:

731.111 Ground-Water Quality Ground-water quality will be protected by the plan described in Section 731 and the following:

(1) Minimizing surface disturbance and proper handling of earth materials to minimize acidic, toxic or other harmful infiltration to ground-water systems. Appendix 6-2 of the MRP presents acid and toxic results from a series of roof and floor samples from the areas north and south of the proposed mine. The samples of the S-24 and S-25 drillholes show the quality of the roof and floor strata located to the south of the proposed operation, while the Lila Fan Portal roof and floor samples show the quality of the strata north of the proposed mine. These samples identified only minor issues with one or two samples for revegetation issues. The recommendations were that these samples would not be a problem when mixed with the surrounding rock. No acid conditions were identified in any of the rock samples. As these samples bracket the mine property and the quality is similar to quality found at other mines along the Book Cliffs and none of these mines have an acid or toxic issue, then it is likely that the rock in the proposed mine area will have the same characteristics.;

(2) Testing (as-necessary) to ensure stockpiled materials are non-acid and non-toxic;

(3) Controlling and treating disturbed area runoff to prevent discharge of pollutants into ground-water, by the use of diversions, culverts, silt fences, sediment ponds and by chemical treatment if necessary;

(4) Minimizing and/or treating mine water discharge to comply with U.P.D.E.S. discharge standards;

(5) Establishing where ground-water resources exist within or adjacent to the permit area through a Baseline Study (done) and monitoring quality and quantity of significant sources through impletation of a Water Monitoring Plan (proposed);

(6) Proper handling of potentially harmful materials (such as fuels, grease, oil, etc.) in accordance with an approved Spill Prevention Control and Countermeasure Plan (SPCC).

731.120 Surface-Water Protection In order to protect the hydrologic balance, coal mining and reclamation operations will be conducted according to the plan approved under 731 and the following:

731.121 Surface-Water Quality Surface-water quality will be protected by handling earth materials, ground-water discharges and runoff in a manner that minimizes the formation of acid or toxic drainage; prevents, to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow outside the permit area; and, otherwise prevent water pollution.

Surface-water quality protection is proposed to be accomplished by the plan described in Section 731 and the following methods:

(1) Minimizing surface disturbance and proper handling of earth materials to minimize acidic, toxic or other harmful infiltration to ground-water systems.

Appendix 6-2 of the MRP presents acid and toxic results from a series of roof and floor samples from the areas north and south of the proposed mine. The samples of the S-24 and S-25 drillholes show the quality of the roof and floor strata located to the south of the proposed operation, while the Lila Fan Portal roof and floor samples show the quality of the strata north of the proposed mine. These samples identified only minor issues with one or two samples for revegetation issues. The recommendations were that these samples would not be a problem when mixed with the surrounding rock. No acid conditions were identified in any of the rock samples. As these samples bracket the mine property and the quality is similar to quality found at other mines along the Book Cliffs and none of these mines have an acid or toxic issue, then it is likely that the rock in the proposed mine area will have the same characteristics. Also, the rock from the access tunnels will be similar to the rock samples for the floor;

(2) Testing (as-necessary) to ensure stockpiled materials are non-acid and non-toxic;

(3) Controlling and treating disturbed area runoff to prevent discharge of pollutants into surface-water, by the use of diversions, culverts, silt fences, sediment ponds, and by chemical treatment if necessary;

(4) Minimizing and/or treating mine water discharge to comply with U.P.D.E.S. discharge standards;

(5) Establishing where surface-water resources exist within or adjacent to the permit area through a Baseline Study (done) and monitoring quality and quantity of significant sources through impletation of a Water Monitoring Plan (proposed);

(6) Proper handling of potentially harmful materials (such as fuels, grease, oil, etc.) in accordance with an approved Spill Prevention Control and Countermeasure Plan (SPCC).

731.122 Surface-Water Quantity Surface water quantity and flow rates will be protected as described in Section 731.

731.200 Water Monitoring The water monitoring program was implemented in July, 2000. Baseline data will be collected (as possible) from new monitoring sites L-1-S through L-4-S. These sites are typically dry and no quality data has been gathered as yet. Sites L-6-G through L-10-G have been monitored for baseline in 1993, 1994, and 1995. These sites, along with IPA-1, IPA-2 and IPA-3, were monitored in December 2000 to determine if they were still viable and to establish a current baseline that will be continuous with operational monitoring.

Preceding each five year permit renewal, ground (springs) and surface waters will be sampled for baseline parameters, same as listed in Tables 7-4 and 7-5. Analysis on baseline and surface waters will be conducted according to the operational monitoring plan. It has been determined that minimum monitoring is required based on minimal impacts and no appropriated surface water use down stream.

731.210 Ground-Water Monitoring The proposed ground-water monitoring plan is based on results of the Baseline Study and PHC determination. Based on results of these studies, the only ground water expected in the permit area is that which has been identified as springs or seeps, and that which may be expected from perched aquifers encountered by the proposed mining. Since no portals are presently discharging on, or adjacent to, the permit area, and since mining has not started, no underground water is presently available for sampling; selected springs are proposed for sampling under the Ground Water Monitoring Plan.

If ground water is encountered in the future mining of a quantity which requires discharge, the water will be monitored in accordance with requirements of this section and a monitoring plan will be proposed at that time.

For purposes of the water monitoring program, springs and seeps are considered ground water and will be monitored as such.

731.211 Ground-Water Monitoring Plan Based on information in the PHC determination (Appendix 7-3), and as indicated above, the only ground water resources on or adjacent to the permit area that can be monitored at this time;

are springs and seeps. See Appendix 7-6 for a detailed description of the water monitoring locations.

There are a total of 11 ground water monitoring sites proposed for this property. (See Table 7-3). Station L-5-G is the potential mine discharge point, and will be monitored at least monthly, or as occurs, in accordance with U.P.D.E.S. Permit requirements. (See Table 7-4) Stations L-5-G, L-7-G, L-8-G,

L-9-G, L-11-G, and L-12-G are significant springs or seeps located over the area of proposed mining. These springs will be monitored on a quarterly basis for parameters listed in Table 7-5.

Station L-6-G (Table 7-3) is in the vicinity of 2 listed water right springs, Mont Spring and Leslie Spring. These springs are within the same small drainage, and may in fact be the same spring. Close examination of spring/seep and baseline monitoring stations show only one site in this drainage with any consistent flows - site H-18; therefore, this site was originally chosen to monitor the Mont and Leslie Springs area. However in recent years L-6-G has been dry and a new wet area upstream of L-6-G, Location L-11-G, has been added to replace site L-6-G. Sampling at L-6-G will be suspended as of the First Quarter of 2003.

Monitoring site L-7-G is intended to monitor a listed site known as Cottonwood Spring. Once again, a close examination of water rights information along with spring/seep and baseline monitoring has shown only one site in this area with any consistency - site #9; therefore, this is the site chosen for monitoring of Cottonwood Spring.

L-8-G is an unnamed spring that matches Earthfax sample site 10.

L-9-G is known as Pine Spring. There are two locations that are identified as Pine Spring. These are water rights 91-2517 and 91-2539, which are part of the same water right filing. In the spring and seep inventories there has never been any flow identified in the area of 91-2517 as the site is located off of the stream channel. It is assumed that the filing for 91-2517 is a duplicate but the location is wrong.

There have been numerous seep/spring notations in the local area, but the only consistent flowing site is 91-2539; this is the site that will be monitored for Pine Spring. In a recent archeological study, the location of the sight that has been monitored as L-9-G was determined using GPS coordinates. The location for this site was determined to be different than what was plotted on the Plates 7-1, 7-1A, and 7-3. Based on this new data, the location of the spring has been updated.

L-10-G is also an unnamed spring that matches Earthfax sample site 14. Since this site is located over 1 mile south of the permit area, it has been replaced with L-12-G which is a more appropriate site to monitor. Monitoring of site L-10-G will be suspended as of the First Quarter of 2003.

L-11-G is located in the bottom of the upper reaches of Lila Canyon. This is in the same drainage as the Mont and Leslie Springs water right locations. In recent years L-6-G (H-18) has been dry. However, there has been some minimum flow observed approximately one hundred yards above L-6-G where L-11-G was established.

L-12-G is an unnamed spring which had been developed but is now abandoned. The seep/spring inventory data is shown in Appendix 7-1 and locations are shown on Plate 7-1. Proposed water monitoring sites are shown on Plate 7-4.

L-13-S, L-14-S, and L-15-S are sites being monitored to assist in characterization of the various drainages.

L-16-G and L-17-G are seeps being monitored in Stinky Spring Canyon. These sites were not identified during baseline surveys and are believed to exist intermittently and are not always evident. These two seeps appear to be an important source of water for Bighorn sheep specifically in the early spring.

It should be noted that data has been gathered on the various seeps/springs as part of the original baseline inventory for the South Lease by I.P.A. The data was gathered over the years 1993, 1994 and 1995 and was stopped. In the second quarter of 2001 water monitoring continued.

IPA-1, 2 and 3 are groundwater piezometers in the Little Park Wash area. These holes will be checked quarterly for water depth only. Monitoring of these sites will continue until the mining or subsidence renders them unusable.

At a minimum, total dissolved solids or specific conductance corrected to 25 degrees C, pH, total iron, total manganese and water levels will be monitored, on all points except IPA-1, 2 and 3.

731.212 Monitoring Reports Ground-water will be monitored and data will be submitted at least every three months for each monitoring location. Monitoring submittals will include analytical results from each sample taken during the approved reporting period. When the analysis of any ground-water sample indicates noncompliance with the permit conditions, then the operator will promptly notify the Division and immediately take the actions provided for in 145 and 731.

731.213 Waiver of Monitoring N/A - No waiver is requested.

731.214 Ground-Water Monitoring Duration Ground-water monitoring will continue through mining and reclamation until bond release. If the ground water is a discharge strictly from the mining operations, monitoring will continue, or until the ground water source is no longer accessible. Other monitoring will continue until:

> **731.214.1** "The coal mining and reclamation operation has minimized disturbance to the prevailing hydrologic balance in the permit and adjacent areas and prevented material damage to the hydrologic balance outside the permit area; water quantity and quality are suitable to support approved postmining land uses"; or,
>
> **731.214.2** until "Monitoring is no longer necessary to achieve the purposes set forth in the monitoring plan approved under R645-301-731.211."

731.215 Monitoring Equipment equipment, structures and other devices used in conjunction with monitoring the quality of ground water on-site and off-site will be properly installed, maintained and operated and will be removed by the operator and will be removed by the operator when no longer needed.

731.220 Surface Water Monitoring Surface water monitoring will be conducted in accordance with the plan described in this section.

Based on results of the PHC determination, base-line study and other available information, numerous small springs and seeps exist within, and adjacent to, the permit area. In addition, ephemeral drainages in the area flow in response to snow melt and precipitation events. The proposed surface-water monitoring program will monitor the significant surface water sources, including drainages above and below the disturbed mine site area, and all point-source discharges (i.e. sediment pond). Seeps, springs and potential mine water discharge will be monitored in accordance with the Ground Water Monitoring Plan in the previous section.

It should be noted that field sheets in Appendix 7-2 refer to a point HC-2, while Bar Graphs and Spreadsheets refer to a station B-1. It has been determined that these are the same point. The site is designated B-1 on Plate 7-1, with a red HC-2 in parenthesis. The electronic data inventory (EDI) also shows both B-1 and HC-2 designations for this site.

Another HC-2 site is listed in the seep/spring inventories in Appendix 7-6 and in the baseline data in Appendix 7-1. This station is also occasionally referred to as H-2 in the seep/spring inventories (Appendix 7-6). It has been determined that the H-2 and HC-2 sites referred to in these 2 appendices are the same station. The station location is shown on Plate 7-1, where it is designated H-2 with a green (HC-2) in parentheses.

There is one other station with confusing designations in the data from Appendix 7-2 and 7-6 - station HCSW-1. This station has 3 different designations in the data - HCSW-1, HSW-1, and HC-1. The point is shown as HC-1 on Plates 7-1 and 7-4; however, a note has been added to Plate 7-1 to show the station is also called (HCSW-1), to eliminate confusion. It should also be noted that there is a seep/spring site designated as H-1 on Plate 7-1. This is not to be confused with any of the above listed HC, HSW or HCSW sites.

These are the only known duplication or wrong designation of sample site numbers. It appears that different samplers or companies conducting seep/spring inventories occasionally used different designations for the same sites - the main problem being the use of H-n or HC-n for the same location, in some instances. Every effort has been made to refine the station identifications and locations on Plate 7-1 to reflect the sampling data provided in Appendices 7-1, 7-2 and 7-6. Wherever a site has 2 different designations, both are shown with one in parentheses.

The following is a list of proposed monitoring sites:

Station No.	Location	Type
L-1-S	Lila Canyon	Intermittent by rule with ephemeral flow
L-2-S	Rt. Fork Lila (above mine)	Ephemeral Stream
L-3-S	Lila Canyon Below Mine	Intermittent by rule with ephemeral flow
L-4-S	Sediment Pond Discharge	UPDES
L-5-G	Mine Water Discharge	UPDES (Groundwater)
L-6-G (suspended)	**Sampling Suspended 1Qtr 2003**	Spring
L-7-G	Cottonwood Spring	Spring
L-8-G	Unnamed Spring	Spring
L-9-G	Pine Spring	Spring
L-10-G (suspended)	**Sampling Suspended 1Qtr 2003**	Spring
L-11-G	Lila Canyon Wash	Spring
L-12-G	Section 25 Wash	Spring
L-13-S	Little Park Wash	Intermittent by rule with ephemeral flow
L-14-S	Section 25 Wash	Intermittent by rule with ephemeral flow
L-15-S (suspended)	**Sampling Suspended 1Qtr 2003**	Intermittent by rule with ephemeral flow
L-16-G	Stinky Spring Wash	Seep
L-17-G	Stinky Spring Wash	Seep
L-18-S	Stinky Spring Wash	Intermittant by rule with ephemeral flow
IPA-1	Little Park Wash	Borehole
IPA-2	Little Park Wash	Borehole
IPA-3	Little Park Wash	Borehole

Sampling at Locations L-13-S, L-14-S, L-15-S, and L-18-S will no longer be required once the washes have been characterized as Intermittent by rule with ephemeral flow or Ephemeral.

Locations of all monitoring sites are shown on Plate 7-4 , "Water Monitoring Location Map".

Proposed monitoring methods, parameters and frequencies are described in Table 7-3, "Water Monitoring Stations", Table 7-4, "Surface Water Monitoring Parameters", and Table 7-5 "Ground Water Monitoring Parameters".

In any one quarter a minimum of three unsuccessful attempts will be made by using either 4 wheel drive vehicles or ATV's to access all water monitoring sites prior to reporting any site as "No Access". However, safety and common sense will prevail while making these attempts.

Monitoring reports will be submitted to the Division at least every 3 months, within 30 days following the end of each quarter.

731.221 Surface-Water Monitoring Plan The proposed surface-water monitoring plan is detailed in Section 731.220. This plan is based on PHC determination and analysis of all baseline hydrologic, geologic and other information in this permit application. The plan provides for monitoring of parameters that relate to the suitability of the surface water for current and approved postmining land uses and to the objectives for protection of the hydrologic balance as set forth in 751 (see Table 7-4).

731.222 Surface-Water Monitoring Parameters The surface-water monitoring parameters are shown in Table 7-4. Water monitoring locations and sample frequencies are described in Table 7-3 and on Plate 7-4 .

The plan will provide data to show impacts to potentially affected springs, seeps, impoundments and drainages within and adjacent to the permit area, by comparison with relevant baseline data and with applicable effluent limitations.

731.222.1 Non-point Source Locations The parameter list in Table 7-4 provides monitoring for all parameters required by this section. The monitoring locations and frequencies described in Table 7-3 show that all significant springs, seeps, impoundments and drainages that could potentially be impacted by the mining and reclamation operations will be monitored on a regular basis.

731.222.2 Point-source Discharges Point-source discharge monitoring will be conducted in accordance with 40 CFR Parts 122 and 123, R645-301-751 and as required by the Utah Division of Environmental Health for Utah Pollutant Discharge Elimination System (U.P.D.E.S.) permits. A U.P.D.E.S. discharge permit application has been submitted to the Division of Environmental Health for the proposed sediment pond and mine water for the Lila Canyon operation. Existing U.P.D.E.S. permit applications for the Lila Canyon Mine are provided in Appendix 7-5.

731.223 Reporting As indicated in Section 731.220, surface-water monitoring data will be submitted at least every 3 months for each monitoring location. When analysis of any surface water sample indicates non-compliance with the permit conditions, the company will promptly notify the Division and immediately take actions to identify the source of the problem, correct the problem and, if necessary, to provide warning to any person whose health and safety is in imminent danger due to the non-compliance.

731.224 Duration Surface-water monitoring will continue through mining and reclamation until bond release. Locations, parameters and/or sampling frequency (other than U.P.D.E.S. discharge points) may be modified by the Division if:

731.224.1 "The operator has minimized disturbance to the hydrologic balance in the permit and adjacent areas and prevented material damage to the hydrologic balance outside the permit area; water quantity and quality are suitable to support approved postmining land uses"; or,

731.224.2 "Monitoring is no longer necessary to achieve the purposes set forth in the monitoring plan approved under 731.221.

731.225 Monitoring Equipment Equipment, structures and other devices used in conjunction with monitoring the quality and quantity of surface water on-site and off-site will be properly installed, maintained and operated and will be removed by the operator when no longer needed.

731.300 Acid- and Toxic-Forming Materials Drainage from acid- and toxic-forming materials and underground development waste into surface water and ground water will be avoided by implementation of a Spill Prevention Control and Countermeasure (SPCC) Plan and by the following:

731.311 Identification/Burial of Acid- or Toxic-Forming Materials
Potentially acid- or toxic-forming materials will be identified by use of Material Safety Data Sheets (MSDS), or by direct sampling and analysis in the case of underground development waste.

Any material which exhibits acid- or toxic-forming characteristics will be properly stored, protected from runoff, removed to an approved disposal site or buried on site beneath a minimum of 4' of non-acid, non-toxic material.

731.312 Storage of Acid- or Toxic-Forming Materials Storage of potentially acid- or toxic-forming materials, such as fuel, oils, solvents and non-coal waste will be in a controlled manner, designed to contain spillage and prevent runoff to surface or ground water resources.

All oils and solvents will be stored in proper containers within enclosed structures. Fuels will be stored in appropriate tanks, enclosed within concrete or earthen bermed areas designed to contain any spillage.

Non-coal waste (garbage) will be stored in a designated location, in dumpsters, and removed to an approved landfill (East Carbon Development Contractors - ECDC) on a regular, as-needed basis.

Unused or obsolete equipment or supplies will be stored in a designated area. Drainage from the storage area will be directed to the sediment pond as shown on the Sediment Control Map, Plate 7-5.

Underground development waste (if any) will also be stored in a designated area. Such waste will be tested for acid- or toxic-forming potential, and if found to be acid- or toxic-forming, the waste site will be protected from surface runoff by the use of earthen berms.

731.320 Storage, Burial, Treatment All storage, burial and treatment practices will be as described in this permit, and consistent with applicable material handling and disposal provisions of the R645-Rules.

731.400 Transfer of Wells There are presently three piezometers on this permit. When these piezometers are no longer required, they will be sealed in a safe, environmentally sound manner in accordance with regulations (see Section 631.200). The Horse Canyon Well will be donated to the College of Eastern Utah as part of the Post Mine Land use Change

731.500 Discharges The only proposed discharges from this operation will be from the sediment pond and/or underground mine water. Each of these potential discharges would be monitored and controlled within requirements of approved U.P.D.E.S. Discharge Permits.

731.510 Discharges into an Underground Mine There are no plans to discharge any water into an underground mine. This section is not applicable.

731.512 Types of Discharge The only planned discharges from this site are water, in the form of sediment pond discharge or underground mine water discharge.

731.512.1 Water See Section 731.512.

731.512.2 Coal Processing Waste N/A - There are no plans to process coal or discharge coal processing waste from this site.

731.512.3 Fly Ash from a Coal-Fired Facility N/A - There are no plans for a coal-fired facility at this time.

731.512.4 Sludge from Acid-Mine-Drainage Treatment N/A There are no plans for an acid-mine-drainage treatment facility at this time.

Table 7-3
Lila Canyon Mine
Water Monitoring Stations

Station	Location	Type	Frequency	Remarks
L-1-S	Lila Canyon	Int. Stream	Monthly	At mine Site
L-2-S	Rt. Fork Lila (above mine)	Ephemeral Stream	Monthly	RF Above Mine Site
L-3-S	Lila Canyon (below mine)	Int. Stream	Monthly	RF Below Mine Site
L-4-S	Sediment Pond	Discharge	Monthly or as occurs	Per UPDES Permit
L-5-G	Mine Water	Discharge	Monthly or as occurs	Per UPDES Permit
L-6-G	Lila Canyon	Spring	Sampling Suspended 1Qtr 2003	Replaced by L-11-G Water Right 91-617
L-7-G	Little Park	Spring	Quarterly	Cottonwood Spring Sample Site 9 Water Right 91-2521
L-8-G	Little Park	Spring	Quarterly	Unnamed Spring Sample Site 10 Water Right 91-2538
L-9-G	Little Park	Spring	Quarterly	Pine Spring Sample Site 16Z Water Right 91-2539
L-10-G	Williams Draw	Spring	Sampling Suspended 1Qtr 2003	Replaced by L-12-G Water Right 91-809
L-11-G	Lila Canyon	Spring	Quarterly	Mont/Leslie Spring Replaces L-6-G Water Right 91-618
L-12-G	Section 25 Spring	Spring	Quarterly	Replaces L-10-G

Table 7-3
Lila Canyon Mine
Water Monitoring Stations

Station	Location	Type	Frequency	Remarks
L-13-S	Little Park Wash	Dry Wash	Monthly	At Road Crossing
L-14-S	Section 25 Wash	Dry Wash	Monthly	At Road Crossing
L-15-S	Williams Draw Wash	Dry Wash	Sampling Suspended 1Qtr of 2003	At Road Crossing
L-16-G	Stinky Spring Wash	Seep	Quarterly	Top of Mancos
L-17-G	Stinky Spring Wash	Seep	Quarterly	Top of Mancos
L-18-S	Stinky Springs Wash	Dry Wash	Monthly	Adjacent to Access Road
L-19-S	Little Park Wash	Dry Wash	Monthly	At Permit Boundary
IPA-1	Little Park	Borehole	Quarterly	Water Level Only
IPA-2	Little Park	Borehole	Quarterly	Water Level Only
IPA-3	Little Park	Borehole	Quarterly	Water Level Only

NOTE: Sites L-13-S, L-14-S, L-15-S, and L-18-S will no longer be monitored after the washes have been characterized.

Table 7-4
Lila Canyon Mine
Surface Water Monitoring Parameters
Operational and Post-Mining

Field Measurements	Reported As
Water Level or Flow	Depth, Flow
pH	Standard Units
Specific Conductivity (ohms/cm)	umhos/cm @ 25° C
Temperature	° C
Dissolved Oxygen	mg/l
Laboratory Measurements	**Reported As**
Total Dissolved Solids	mg/l
Total Settleable Solids	(UPDES)
Total Suspended Solids	mg/l
Total Hardness ($CACO_3$)	mg/l
Total Alkalinity	mg/l
Carbonate (CO_3^{-2})	mg/l
Bicarbonate ($(HC)_3^{-1}$)	mg/l
Calcium (Ca) (Dissolved)	mg/l
Chloride (Cl^-)	mg/l
Iron (Fe) (Dissolved)	mg/l
Iron (Fe) (Total)	mg/l
Magnesium (Mg) (Dissolved)	mg/l
Manganese (Mn) (Dissolved)	mg/l
Manganese (Mn) (Total)	mg/l
Potassium (K) (Dissolved)	mg/l
Sodium (Na) (Dissolved)	mg/l
Sulfate (SO_4^{-2})	mg/l
Oil and Grease (As required)	mg/l
Cations	meq/l
Anions	meq/l

Table 7-5
Lila Canyon Mine
Ground Water Monitoring Parameters
Operational and Post-Mining

Field Measurements	Reported As
Water Level or Flow	Depth, Flow
pH	Standard Units
Specific Conductivity	umhos/cm @ 25° C
Temperature	° C
Laboratory Measurements	Reported As
Total Dissolved Solids	mg/l
Total Hardness ($CACO_3$)	mg/l
Total Alkalinity	mg/l
Carbonate (CO_3^{-2})	mg/l
Bicarbonate ($(HC)_3^{-1}$)	mg/l
Calcium (Ca) (Dissolved)	mg/l
Chloride (Cl^-)	mg/l
Iron (Fe) (Dissolved)	mg/l
Iron (Fe) (Total)	mg/l
Magnesium (Mg) (Dissolved)	mg/l
Manganese (Mn) (Dissolved)	mg/l
Manganese (Mn) (Total)	mg/l
Potassium (K) (Dissolved)	mg/l
Sodium (Na) (Dissolved)	mg/l
Sulfate (SO_4^{-2})	mg/l
Oil and Grease (As required)	mg/l
Cations	meq/l
Anions	meq/l

731.512.5 Flue-gas Desulfurization Sludge N/A - There are no plans for flue-gas desulfurization at this site.

731.512.6 Inert Materials N/A - There are no plans to use or discharge inert materials used for stabilizing underground mines.

731.512.7 Any underground mine development wastes that cannot be left and permanently stored underground will be brought to the surface and stored in a controlled, designated location. Final disposal of such material will depend on its volume, physical and chemical characteristics and potential for use in reclamation. There are presently no plans to return such material underground; however, if this does become necessary in the future, complete plans will be submitted for disposal at that time.

731.513 Water from Underground Workings Based on historical data from other mines in the area, some mine water can be expected to be encountered during the mining operation. Typically, such water is stored in "sumps" or designated areas in the mine and used for mining operations or discharged to the surface. A sump is an underground storage area that is used to temporarily store water before it is used underground or pumped to the surface for discharge. The main purpose of a sump is to remove sediments. The sump will also remove oil/grease if they were to get into the water. The size of a sump can vary from a few hundred gallons to several thousand gallons. The size normally depends on the space available and the amount of water needed for mining operations.

In order to more accurately define the potential impact of the mine on ground water, underground usage discharge amounts, if they were to occur, would be documented. This information along with the surface monitoring program will provide the best information available as to the potential impact of the mine on ground water.

IPA piezometers 1-3 will still be monitored quarterly if possible. The three piezometers were monitored on December 22, 2000. The water level probe during this period was unable to reach the depth required to measure the water level of IPA-1 and IPA -3. Another attempt will be made to enter these piezometers when the sites are accessible.

The water level of IPA-2 was very consistent with the last reading taken on April 29, 1996. This piezometer (IPA-2) is the farthest west of the three piezometers and is up dip from the other two. Any impact to ground water would be noticed very quickly at IPA-2. This information from IPA-2 along with the past baseline data on the three piezometers and the in mine water monitoring program mentioned above, would provide an accurate evaluation of potential ground water impacts.

At the present time, there are no plans to divert water from the underground workings of this operation to any other underground workings.

If it became necessary to discharge water from the mine, this water would be discharged in accordance with the UPDES permit application in Appendix 7-5. The water would be discharged into the Right Fork of Lila Canyon. Refer to Plate 7-5.

731.520 Gravity Discharges Location of the proposed portal slopes are below the western (upper) exposure of the easterly dipping coal bed. In the area immediately around the proposed portals, no water is presently issuing from the strata above or below the coal outcrop; therefore, it is assumed any water encountered in the underground mining will not be under artesian pressure or with sufficient hydrostatic head to raise it to the portal site.

The coal seam to be mined dips away from the portal site at approximately 10%. If water is encountered in the mining, it will likely be at a static level far below the exposed outcrop or rock slopes. This may result in some possible mine discharge from pumping, but not from gravity.

731.521 Portal Location The proposed access portals are below the coal outcrop, as shown on Figure 7-1, Plates 5-5 and 7-5. The fan is to be located above, at the outcrop. The rock slopes will slope up to the east at approximately 12% to contact the coal seam; however, the coal seam is dipping down to the east in this area. The approximate point of contact between the rock slopes and the coal seam will be 1227' from the surface at an elevation of 6300'. Ground water levels in the mining area, based on the 3 water monitoring

holes and other geologic data, appear to be nearly static at elevation 5990 in this area (see Figure 7-1).

Water level in the mine would have to raise approximately 310' to reach the rock slope/coal seam contact and result in a gravity discharge. Water monitoring results and other historical data in the area do not indicate this is likely to occur.

731.522 Surface Entries after January 21, 1981 This is not known to be an acid-producing or iron-producing coal seam; however, proposed portals are located to prevent gravity discharge from the mine (see Section 731.521).

731.600 Buffer Zones All streams within the permit area are either ephemeral or intermittent by rule with ephemeral flow. In the area of the surface facilities along the intermittent by definition Lila Wash, the Operator will install stream buffer zone signs in locations shown on Plate 5-2 and maintain the buffer zones during the operation.

731.700 Cross Sections and Maps The following is a list of cross-sections and maps provided in this section of the P.A.P.

Plate 7-1	Permit Area Hydrology Map
Plate 7-2	Disturbed Area Hydrology/Watershed
Plate 7-3	Water Rights Locations
Plate 7-4	Water Monitoring Location Map
Plate 7-5	Proposed Sediment Control Map
Plate 7-6a	Proposed Sediment Pond #1
Plate 7-6b	Proposed Sediment Pond #2
Plate 7-7	Post-Mining Hydrology

All required maps and cross-sections have been prepared by, or under the supervision of, and certified by a Registered Professional Engineer, State of Utah.

731.710 General Area Hydrology Plate 7-1.

731.720 Plate 7-2.

731.730 Water Monitoring Map Plate 7-4.

731.740 Sediment Pond Map Plates 7-6a and 7-6b.

731.750 Plate 7-6a & b.

731.760 Other Maps (See Section 731.700 for a complete list of maps provided in this section).

731.800 Water Rights and Replacement (See Section 727)

732. Sediment Control Measures

732.100 Siltation Structures The only proposed siltation structures for this site are the sediment ponds. All disturbed area runoff is proposed to be directed to these ponds for final treatment prior to discharge.

The sediment ponds will be constructed and maintained in compliance with applicable regulations. Details of the proposed ponds are discussed in the following section and in Appendix 7-4.

732.200 Sedimentation Ponds As discussed above, all disturbed area runoff is proposed to be directed to the sediment ponds for final treatment prior to any discharge. The proposed sediment ponds will be located at the low points of the disturbed area, as shown on Plate 7-5.

732.210 Sediment Pond Details The proposed sediment ponds are considered <u>temporary</u>, and will be removed during final reclamation. The ponds are designed in compliance with the requirements of the following sections, as required:

356.300 - The ponds will be maintained until the disturbed area has been stabilized and revegetated. Removal shall not be any sooner than 2 years after the last augmented seeding;

356.400 - Upon removal, the pond areas will be reclaimed and reseeded according to the reclamation plan;

513.200 - N/A - The proposed sediment ponds do <u>not</u> meet the size or other qualifying criteria of MSHA, 30 CFR 77.216(a);

763 - Refer to this regulation addressed later in this chapter.

Design details for the sediment ponds and site drainage control are addressed in Appendix 7-4 of this P.A.P.

732.220 MSHA Requirements This section does not apply since there are no plans for construction of coal processing waste dams or embankments at this site. The proposed ponds do <u>not</u> meet the size or other qualifying criteria of MSHA, 30 CFR 77.216(a).

732.300 Diversions There is one undisturbed diversion planned for this site. This diversion consists of a bypass culvert beneath sediment pond No. 1, which will allow undisturbed runoff to bypass the site without mixing with disturbed area runoff.

Other diversions planned consist of disturbed area ditches and culverts, as shown on Plate 7-5. Design details for all diversions are provided in Appendix 7-4.

All diversions will be constructed and maintained to comply with the requirements of R645-301-742.100 and R645-301-742.300. Details are described under those respective sections of this chapter.

732.400 Road Drainage All roads will be constructed, maintained and reconstructed to comply with R645-301-742.400. Specific information to road drainage is provided under that section of this chapter.

732.410 Alteration or Relocation of Natural Drainages There are no plans to construct roads which will require alteration or relocation of natural drainageways, other than by providing culverted crossings over ephemeral drainages. There are no plans to alter or relocate any intermittent or perennial drainages in conjunction with road construction.

Road construction and design details are provided in Chapter 5 of this P.A.P. Road drainage and culvert design details are provided in Appendix 7-4.

732.420 Culverts Culvert details are provided in Appendix 7-4. All undisturbed culvert inlets will be provided with headwall protection, consisting of inlet sections, rock or concrete.

733. Impoundments The only water impoundment proposed for this site are the sediment ponds. Design details for the ponds are provided in Appendix 7-4 and on Plates 7-6a &b.

733.100 General Plans The general plan for this site is to drain runoff from the disturbed area into two sedimentation ponds for treatment prior to discharge. Site drainage and design details are described in Appendix 7-4. The general plan includes the following, at a minimum:

733.110 Certification The sediment control plan and proposed sediment pond designs have been prepared and certified by a Registered Professional Engineer, State of Utah.

733.120 Maps and Cross Sections Sediment pond locations, design plans and cross sections are provided on Plates 7-5 and 7-6a & b, respectively.

733.130 Narrative A complete description of the proposed sediment ponds along with volumes and design/construction details in provided in Appendix 7-4.

733.140 Survey The proposed sediment ponds are <u>not</u> located within a potential subsidence area from past underground mining operations.

733.150 Hydrologic and Geologic Information Relevant hydrologic and geologic information for the sediment ponds are provided in Appendix 7-4.

733.160 Certification Statement All proposed sediment pond structures are provided with this submittal. The structures will be constructed prior to construction of the mine site area, but not before receiving Division approval.

733.200 Permanent and Temporary Impoundments As indicated earlier, the proposed sediment ponds are classed as temporary.

733.210 Design Requirements The proposed sediment ponds are temporary; therefore, the ponds are not designed to meet requirements of MSHA 30 CFR 77.216.

The proposed ponds are not located where failure would expect to cause loss of life or serious property damage. As shown in Appendix 7-4, the proposed pond embankments will have a minimum of 3H : 1V on the inside slope and 2H : 1V on the outside. These slopes, along with the 95% compaction requirement, will ensure a static safety factor in excess of 1.3, as required.

733.220 Permanent Impoundment Section 733.220 is not applicable since the impoundments will be temporary.

733.230 Temporary Impoundment The proposed sediment ponds are temporary impoundments, and will be removed when reclamation sediment control and revegetation criteria are met, in accordance with Phase II Bond Release criteria.

733.240 Inspections/Potential Hazards As indicated under Section 515.200, if any examination or inspection shows a potential hazard exists, the person who examined the impoundments will promptly notify the Division of the finding and emergency procedures formatted for public protection and remedial action.

734. Discharge Structure All discharges from sedimentation ponds, diversions and culverts will be protected from erosion by the use of adequately sized rip-rap, concrete or other approved protection. Details for outlet protection for all drainage control structures are provided in Appendix 7-4. All discharge structures have been designed according to standard engineering design procedures.

735. Disposal of Excess Spoil No excess spoil production is anticipated.

736. Coal Mine Waste Any areas designated for the disposal of coal mine waste will be constructed and maintained to comply with R645-301-746. Details are described under that section.

737. Noncoal Mine Waste Storage and final disposal of noncoal mine waste are described under section 747.

738. Temporary Casing and Sealing of Wells There are no wells proposed to be used to monitor ground water conditions associated with this permit or operation. The three Piezometers will be reclaimed according to the requirements of the Divisions's Performance Standards.

740. Design Criteria and Plans Design criteria and plans for this permit are detailed in Appendix 7-4. The following section will describe the general drainage and sediment control plan.

741. General Requirements The proposed operation is an underground mine with a relatively small surface disturbance for transportation, support and coal handling facilities. The proposed surface facilities will comprise a disturbed perimeter of approximately 42.6 acres. Access roads and utility lines will consist of approximately 10 acres of additional disturbance along a BLM Right-of-Way designated as a "Transportation Corridor".

The majority of undisturbed runoff from areas above the proposed mine site will be diverted beneath the site via an undisturbed diversion culvert. Runoff from the disturbed mine site area will be directed to two sediment ponds, designed to contain and treat the runoff from a 10 year - 24 hour precipitation event for the contributing watersheds. Disturbed area runoff will be directed to the sediment ponds via a combination of properly sized ditches and culverts. The general drainage control plan for the mine site is shown on Plate 7-5. The complete Drainage Design and Control Plan is provided in Appendix 7-4 of this P.A.P.

742. Sediment Control Measures See Appendix 7-4 for Sediment Control Measure details.

742.100 General Requirements

742.110 Designed/Constructed/Maintained Appropriate sediment control measures will be designed, constructed and maintained using the best technology currently available to:

742.111 "Prevent, to the extent possible, additional contributions of sediment to stream flow or to runoff outside the permit area;"

This will be accomplished by the construction of undisturbed diversions to allow most undisturbed runoff to by-pass the site and by routing all disturbed runoff to sediment ponds for treatment prior to discharge.

742.112 "Meet the effluent limitations under R645-301-751;"

Any discharge from the sediment ponds will be made in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR Part 434.

742.113 "Minimize erosion to the extent possible:" This will be accomplished by proper routing of drainage, and by the use of energy dissipators and/or erosion protection at all sediment pond, ditch and culvert outlets and in ditches where erosive velocities are expected.

742.120 Sediment Control Measure Sediment control measures within and adjacent to the disturbed areas are detailed in Appendix 7-4. These measures include, but are not limited to:

742.121 As discussed in Appendix 7-4, runoff from the disturbed area will be captured in sediment ponds and/or treated as necessary to meet effluent limitations prior to discharge.

742.122 As discussed in Appendix 7-4, the majority of undisturbed drainage from above the mine site will be diverted via designed undisturbed diversions.

742.123 Undisturbed diversions will consist of properly designed and protected channels and/or culverts as described in Appendix 7-4.

742.124 The primary means of velocity reduction is planned to be the use of rip-rap; however, other methods such as straw dikes, check dams and/or vegetative filters may be employed during the operational or reclamation phases as determined necessary, and with Diversion approval.

742.125 There are no plans to treat runoff with chemicals. Based on extensive experience with runoff in this area, effluent requirements for discharge can normally be met by containment and settling in a sediment pond.

742.126 It is expected that water will be encountered in the underground mining; however, this water will be used for mining needs and only discharged when no further storage is available underground. Any discharge of mine water will meet applicable effluent limitations. Such water will be sampled (and treated if necessary) prior to discharge.

742.200 Siltation Structures As described in Appendix 7-4 the sediment ponds will provide for sediment removal for most of the surface facility disturbance. An alternate sediment control method of berms and silt fences will be used at the fan site, around the topsoil stockpile area, and on the slopes below the water treatment area and portal access road. The description of this alternate sediment control method is also described in Appendix 7-4. In the case of the fan site, this is necessary due to its remote location and rough terrain. In the case of the water treatment slope, due to topography, there is no way to direct the runoff to the sediment basins. Other sediment structures that might be used around the surface facilities are temporary sediment traps such as straw dikes and/or catch basins.

742.210 General Requirements Siltation structures will be designed, constructed and maintained in accordance with the following regulations.

742.211 Siltation structures will be constructed using the best technology currently available to prevent additional contributions of suspended solids and sediment to streamflow outside the permit area to the extent possible. Sediment control structures and details are discussed in Appendix 7-4.

742.212 The siltation structures (i.e. sediment ponds) will be constructed prior to any coal mining and reclamation operations. Upon construction, the ponds and any other siltation structures will be certified by a qualified registered professional engineer to be constructed as designed and approved in the reclamation plan.

742.213 The sediment ponds will be designed, constructed and maintained in accordance with all applicable regulations. See 732.200, 733.200 and Appendix 7-4 for details.

742.214 Any discharge of water from underground workings to surface waters will meet applicable effluent limitations of 751. If such water is found not to meet those requirements, the water will be treated underground prior to discharge, or passed through a siltation structure prior to leaving the permit area.

742.220 Sedimentation Ponds The sedimentation ponds will meet the following criteria:

742.221.1 The ponds will be used individually;

742.221.2 The ponds are located at the lower end of the disturbed area and out of any perennial stream (See Plate 7-5);

742.221.3 The sediment ponds will be designed, constructed and maintained to:

742.221.31 The ponds are designed to contain the runoff from a 10 year - 24 hour precipitation event for the area in addition to a minimum of 2 years of sediment storage.

742.221.32 The ponds are designed to provide a minimum of 24 hour retention of the runoff from a 10 year - 24 hour precipitation event.

742.221.33 The ponds are designed to contain the runoff from a 10 year - 24 hour precipitation event plus a minimum of 2 years of sediment storage.

742.221.34 Nonclogging dewatering devices are proved as described in Appendix 7-4.

742.221.35 This will be accomplished by proper design, construction and maintenance of the ponds as described in Appendix 7-4.

742.221.36 As discussed in Appendix 7-4, sediment will be removed when the level reaches the 2 year storage level. Since the ponds are oversized, this leaves adequate room for storage of the design event.

742.221.37 The sediment ponds construction ensures against excessive settlement. See "Design and Construction Specifications for Sedimentation Pond" in Appendix 7-4.

742.221.38 Sediment ponds will be free of sod, large roots, frozen soil, and acid- or toxic-forming coal processing waste. See "Design and Construction Specifications for Sedimentation Pond" in Appendix 7-4.

742.221.39 The sediment ponds will be compacted properly. See "Design and Construction Specifications for Sedimentation Pond" in Appendix 7-4.

742.222 Sediment Ponds Meeting MSHA Criteria The proposed ponds do not meet the size or other qualifying criteria of MSHA, 30 CFR 77.216(a). Therefore, this section is not applicable.

742.223 Sediment Ponds Not Meeting MSHA Criteria As discussed in Appendix 7-4, the ponds will be equipped with principle spillway and emergency spillway culverts each sized to safely discharge runoff from a 25 year - 6 hour precipitation event.

742.223.1 The Principle Spillway culverts and the Emergency Spillway culverts will be corrugated, metal pipe. Each one designed to carry sustained flows.

742.223.2 N/A - See 742.223.1

742.224 N/A - See 742.223.1

742.225 N/A - No exception requested.

742.225.1 N/A

742.225.2 N/A

742.230 Other Treatment Facilities No other treatment facilities are planned for this operation. Therefore, Section 742.230 is not applicable.

742.240 Exemptions No exemptions are requested at this time; however, since this is a new proposed operation, the need for Small Area Exemptions and/or Alternate Sediment Control Areas may arise in the future.

742.300 Diversions

742.310 General Requirements

742.311 All diversions are considered temporary, and will be removed upon final reclamation.

Diversions are designed to minimize adverse impacts to the hydrologic balance within the permit and adjacent areas, to prevent material damage outside the permit area and to assure the safety of the public detailed diversion designs are presented in Appendix 7-4 of this P.A.P.

742.312 See Appendix 7-4 for diversion designs.

742.313 As indicated, all diversions for the Lila Canyon Mine are temporary, and will be removed when no longer needed. Land disturbed by removal will be reclaimed in accordance with R645-301 and R645-302. Prior to diversion removal, downstream water treatment facilities will be modified or removed. See Reclamation Hydrology Section of Appendix 7-4.

742.320 Diversion of Perennial and Intermittent Steams Section 742.320 is not applicable since there are no diversions planned for perennial or intermittent streams within the permit area.

742.330 Diversion of Miscellaneous Flows All diversions within the permit area are of miscellaneous flows.

742.331 Certain miscellaneous undisturbed flows are proposed to be diverted around the disturbed area. Other flows are diverted within the disturbed area and to the sediment ponds, as described in Appendix 7-4.

742.332 See Appendix 7-4.

742.333 All temporary diversions are designed to safely pass the peak runoff of a 10-year 6-hour event resulting in a more robust design that the required 2-year 6-hour precipitation event. See Appendix 7-4 for details.

742.400 Road Drainage

742.410 All Roads All roads are designed in accordance with requirements of 534. Drainage control for all roads is discussed in detail in Appendix 7-4. No part of any road is planned to be located in the channel of an intermittent or perennial stream. As shown on Plate 7-2, roads are located to minimize downstream sedimentation and flooding.

742.420 Primary Roads Primary road design is discussed under 534.

742.421 As described in Section 534, all primary roads are to be located, insofar as practical, on the most stable available surfaces.

742.422 There are no stream fords planned for this operation.

742.423 Drainage Control Road drainage control is discussed in Appendix 7-4.

742.423.1 Primary roads will be equipped with adequate drainage control, including ditches, culverts and relief drains. The drainage control system is designed, and will be constructed and maintained, to pass the peak runoff safely from a 10 year - 6 hour precipitation event, as described in Appendix 7-4.

742.423.2 Culvert design and installation details are described in Appendix 7-4. Inlets and outlets are protected from erosion. Undisturbed culvert inlets are to be equipped with trash racks.

742.423.3 Drainage ditch design details are provided in Appendix 7-4.

742.423.4 There are plans to alter the drainage channel on the south boundary of the disturbed area. This drainage is an ephemeral channel with no riparian habitat. A stream alteration permit will not be required for this channel. A by-pass culvert and a sedimentation pond will be placed in this channel. Installation of this culvert and sedimentation control plans are described in Appendix 7-4. To ensure that state of the art technology is incorporated, the final reclamation plans for the sedimentation pond area will be submitted prior to commencement of final reclamation of this area.

742.423.5 Stream channel crossings will be provided by culverts designed, constructed and maintained using current, prudent engineering practice, as described in Appendix 7-4.

743. Impoundments

743.100 General Requirements All impoundments associated with this operation are considered temporary.

743.110 Not applicable there are no impoundments planned that meet the criteria of MSHA, 30 CFR 77.216 (a).

743.120 The design of impoundments have been prepared and certified by a qualified, registered professional engineer. As described in Appendix 7-4, the proposed sediment ponds will have at least 2' of freeboard above the highest flow level in the emergency spillway, which is adequate to resist overtopping by waves and by sudden increases in storage volumes.

743.130 As described in Appendix 7-4, the sediment ponds will be equipped with a culvert riser principal spillway and a culvert riser emergency overflow sized to safely pass the runoff from a 25 year - 6 hour precipitation event.

743.131 The principal spillway design is discussed below.

743.131.1 The principle spillway will be constructed of corrugated metal pipe. The emergency spillway will also be constructed of corrugated metal pipe.

744. Discharge Structures

744.100 The sediment ponds emergency spillway will be a vertical corrugated metal pipe. For Sediment Pond 1, it will flow into the UC-1 C.M.P. beneath the pond and discharge onto an engineered rip-rap apron to prevent scouring or erosion. For Sediment Pond 2, the discharge will be via C.M.P. (See Appendix 7-4).

Diversions and culvert outlets that are expected to have flow velocities in excess of 5 fps will also be equipped with erosion and velocity controls as described in Appendix 7-4.

744.200 Discharge structures have been designed and certified according to standard engineering design procedures. (See Appendix 7-4).

745. Disposal of Excess Spoil Section 745 is not applicable since there are no plans for disposal of excess spoil at the Lila Canyon operation.

746. Coal Mine Waste The area designated for coal mine waste disposal is within an existing depression area which is located beneath and around the proposed coal storage pile area as shown on Plates 5-2, 7-2 and 7-5. This disposal area will be used for disposal of the rock slope material, reject from coal processing, coal contaminated waste from the mine (i.e. roof falls, etc.) and/or sediment pond waste.

The designated waste area will be within the disturbed area and drained to the sediment pond, and will be constructed according to Division and MSHA requirements. Coal mine waste disposal is discussed in detail under Section 536 of this permit.

746.100 General Requirements

746.110 All coal mine waste will be placed in a new disposal area within the permit area as discussed in Section 536 and 746.

746.120 The area selected for coal mine waste disposal will drain to the sediment pond for final treatment to minimize adverse effects on the surface and ground water quality and quantity. (See Plates 7-2 and 7-5).

746.200 Refuse Piles. The refuse area is described under Coal Mine Waste in Section 746 and detailed in Section 536. Rock slope material will be used as fill and is referred to as refuse. No coal refuse pile is anticipated. Other than described in Section 536.

746.210 In the event a refuse pile is needed for future operations the refuse piles would be designed to meet the requirements of the above listed Division regulations as well as applicable MSHA regulations. See Section 536 for details.

746.211 The coal mine waste disposal areas will not be located in an area containing springs, seeps or water courses. As shown on Plates 5-2 and 7-5 and described in Appendix 7-4, runoff from the areas will be drained to the sediment pond.

746.212 As described in Sections 536 and 746, the coal refuse will be placed within the mine workings, rock slope material will be placed in existing depression areas. These areas are below grade and will drain to the sediment pond. Due to the location (below grade) no berms or diversion ditches are planned for the Coal Mine Waste Area. See Appendix 7-4 for hydrologic details.

746.213 Not applicable since there are no underdrains planned for this pile.

746.220 Surface Area Stabilization

746.221 The plan for revegetation of the area is discussed in Section 536.

746.222 There are no plans for any permanent impoundments on the refuse or Coal mine waste area. Small depressions may exist for a short time until regrading is completed. These depressions are normally less than one foot in depth and not left for more than 30 days.

746.300 This section is not applicable since there are no plans to construct any impounding structures of coal mine waste or to impound coal mine waste.

746.400 This section is not applicable since there are no plans to return coal processing waste to abandoned underground workings.

747. Disposal of Noncoal Waste. Disposal of non-coal mine waste is discussed under Section 528.330 of this permit.

747.100 As indicated in Section 528.330, non-coal mine waste will be stored in a controlled manner in a designated area on site. Final disposal of all noncoal mine waste , except concrete during reclamation, will be in a state-approved solid waste disposal area (E.C.D.C.).

747.200 As shown on Plates 5-2B and 7-5, the proposed noncoal mine waste storage area is in a designated site, free of springs or seeps, and drained to the sediment pond.

747.300 There are no plans to dispose of noncoal mine waste within the permit area, except concrete during reclamation. The concrete will be buried beneath a minimum of 2' of non-acid, non-toxic material, and will not degrade surface or ground water.

748. Casing and Sealing of Wells There are only three ground water piezometers on the site IPA-1, IPA-2 and IPA-3. They will be reclaimed according to the requirements of the Division's Performance Standards. If any additional wells are required in the future, requirements of this section will be met.

750. Performance Standards

751. Water Quality Discharges of water from this operation will be made in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U. S. Environmental Protection Agency set forth in 40 CFR Part 434. See Sections 731 and 742.

752. Sediment Control Measures Sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs described under Sections 732, 742, 760 and Appendix 7-4.

752.100 Siltation Structures Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs described under Sections 732, 742, 763 and Appendix 7-4.

752.200 Road Drainage Roads will be located, designed, constructed, reconstructed, used, maintained and reclaimed as described under Sections 732.400, 742.400 and 762.

752.210 Control or Prevent Erosion See Section 742.400 and Appendix 7-4.

752.220 Control or Prevent Additional Disturbance See Section 742.400 and Appendix 7-4.

752.230 Effluent Standards See Section 742.400 and Appendix 7-4.

752.240 Degradation of Ground Water Systems See Section 742.400 and Appendix 7-4.

752.250 Altering Normal Flow of Water See Section 742.400 and Appendix 7-4.

753. Impoundments and Discharge Structures Impoundments and discharge structures will be located, maintained, constructed and reclaimed as described in Sections 733, 734, 743, 745, 760 and Appendix 7-4.

754. Disposal of Excess Spoil, Coal Mine Waste and Noncoal Mine Waste Disposal areas for excess spoil, coal mine waste and noncoal mine waste will be located, maintained, constructed and reclaimed to comply with Sections 735, 736, 745, 746, 747 and 760.

755. Casing and Sealing of Wells Not applicable since no wells are planned for this site. The three Piezometers will be reclaimed according to the requirements of the Divisions's Performance Standards.

760. Reclamation Reclamation hydrology is detailed in Appendix 7-4.

761. General Requirements Upon completion of operations, the disturbed area will be reclaimed. All drainage and sediment controls are considered temporary and will be removed when no longer required. The sediment pond will remain in place until Phase II Bond Release requirements have been met. At that time, the pond will be removed and the area will be reclaimed in accordance with the approved plan.

762. Roads All roads within the disturbed area are temporary, and will be removed and reclaimed upon completion of operations. An access road will be left in place to reach the sediment pond; however, this road will also be removed and reclaimed when the sediment pond is removed.

762.100 Upon removal of roads, culverts and diversions will also be removed and the natural drainage patterns will be restored.

762.200 Cut and fill slopes will be reshaped according to the approved reclamation plan. This reshaping will be compatible with the postmining land use and will complement the drainage pattern of the surround terrain. Road reclamation is described in Section 550.

763. Siltation Structures. See Appendix 7-4 for details on removal of siltation structures.

763.100 Siltation Structures will be Maintained. As indicated in Section 761, the sediment pond will remain in place until the stability and vegetation requirements for Phase II Bond Release are met. This will be a minimum of 2 years after the last augmented seeding. At this time, the pond will be removed and the area reclaimed.

763.200 Structure is Removed Upon removal of the sediment pond, the area will be regraded and revegetated in accordance with the approved reclamation plan and Sections 358, 356 and 357.

764. Structure Removal A timetable for reclamation activities is provided in Section 542.100.

765. Permanent Casing and Sealing of Wells There are only three ground water piezometers on the site IPA-1, IPA-2 and IPA-3. They will be reclaimed according to the requirements of the Division's Performance Standards. If any additional wells are required in the future, requirements of this section will be met.

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would not reach the Colorado Drainage in any reasonable time, if ever, and thus water consumed underground cannot negatively effect the Colorado River Basin.

Surface Dust Suppression It has been estimated that usage on the surface for dust suppression will be approximately 10,000 gallon per day or 3,650,000 gallons per year. This results in a usage of 11.20 acre feet per year.

Direct Diversions - no consumption.

Adding the four losses due to mining equals to 80.81 acre feet which is below the mitigation level of 100 acre feet. UEI does hold 362.76 acre feet of underground water rights to offset any consumption. Therefore, it is the opinion of UtahAmerican Energy, Inc. that water consumption by underground coal mining operation will NOT jeopardize the existence of or adversely modify the critical habitat of the Colorado River endangered fish species.

The Permittee is aware that regardless of state-appropriated water rights held by the Permittee, ay water consumption over 100 acre-feet per year is subject to a per acre-foot fee payable to the USFWS. And, that the actual water consumption reported in the annual report once mining operations have commenced, might be subject to a Section 7 consultation with the USFWS.

Conclusion

Based on available data and expected mining conditions, the proposed mining and reclamation activity is not expected to proximately result in contamination, diminution or interruption of an underground or surface source of water within the proposed permit or adjacent areas which is used for domestic, agricultural, industrial, wildlife or other legitimate purpose.

It should be noted that the determination of no known depletion of flow or quality is based on available data, which is primarily post-mining. UtahAmerican Energy Inc. will report actual water depletion values annually in the Annual Report.

Appendix 7-4
Lila Canyon Mine
Sedimentation and Drainage Control Plan

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Revised
January 2001
October 2002 RJM
February 2007 TJS
April 2008 TJS
July 2008 TJS
June 2009 TJS
January 2010 TJS

SEDIMENTATION AND DRAINAGE CONTROL PLAN

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SEDIMENTATION AND DRAINAGE CONTROL PLAN

1- Introduction

The Sedimentation and Drainage Control Plan for the Lila Canyon Mine has been designed according to the State of Utah R645- Coal Mining Rules, November 1, 1996. All design criteria and construction will be certified by a Utah Registered Professional Engineer.

This plan has been divided into the following three sections:

1) Design of Drainage Control Structures for the Proposed Construction

2) Design of Sediment Control Structures

3) Design of Drainage Control Structures for Reclamation

The general surface water control plan for this project will consist of the following:

(a) This is a new site construction. All areas proposed for disturbance will be sloped to drain to surface ditches and/or culverts where runoff will be carried to two sediment ponds. All minesite drainage controls and watersheds are shown on Plate 7-5 "Proposed Sediment Control Map".

(b) The majority of undisturbed runoff will be diverted around the minesite and/or beneath the sediment pond #1 by properly sized culverts. Undisturbed diversion culvert UC-1, is located on the northwest end of the site. This diversion will allow the majority of undisturbed runoff from the Right Fork of Lila Canyon to bypass the mine area beneath sediment pond #1. All undisturbed diversions are designed to carry runoff from a 100 year - 6 hour precipitation event. UC-1 is oversized at 60" diameter.

(c) Two adequately sized sediment ponds will be constructed at the lower end of the site. These ponds are sized to contain and treat the runoff from all of the disturbed area and any contributing undisturbed areas for a 10 year - 24 hour precipitation event. The ponds will be equipped with C.M.P. culvert principle spillway and decant and CMP culvert emergency spillway sized to safely pass runoff from a 25 year - 6 hour precipitation event. The spillways from sediment pond #1 will discharge into the UC-1 CMP culvert running beneath the pond. This culvert will discharge onto an engineered discharge structure and into the Right Fork of Lila Canyon channel below the minesite. The spillways from sediment pond #2 will discharge onto an engineered discharge structure and into the Middle Fork of Lila Canyon channel below the minesite.

DESIGN OF DRAINAGE CONTROL STRUCTURES

Design Parameters:

Tables:

Figures:

Design Parameters

2.1 Precipitation

The precipitation-frequency values for the area were taken from the approved Mining and Reclamation Plan, Horse Canyon Mine, Emery County, Utah, Volume III, submitted by I.P.A.

Frequency - Duration	Precipitation
10 year - 6 hour	1.30"
10 year - 24 hour	1.90"
25 year - 6 hour	1.50"
100 year - 6 hour	1.90"

2.2 Flow

Peak flows, flow depths, areas and velocities were calculated using the computer program "Office of Surface Mining Watershed Model", Storm Version 6.21 by Gary E. McIntosh. All flows are based on the SCS - TR55 Method for both SCS 6-hour and NOAA Type II, 24-hour storms.

Time of concentration of storm events were calculated for each drainage area using the SCS upland curve method included as part of the Storm software. For the undisturbed areas UA-1 and UA-4 the watershed type was set at forested and the curve condition was set at bare ground. For UA-5, UA-6a and UA-6b and all DA watersheds, the watershed type was set as disturbed and the curve condition was set at bare ground.

2.3 Velocity

Flow velocities for each ditch structure were calculated using the Storm computer program with Manning's Formula:

$$V = \frac{1.49}{n} R^{2/3} S^{1/3}$$

where:			
	V	=	Velocity (fps)
	R	=	Hydraulic Radius (ft.)
	S	=	Slope (ft. per ft.)
	n	=	Manning's n; Table 3.1, p. 159,

"Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner & Haan, 1983.

Note: The following Manning's n were used in the calculations:

Structure	Manning's n
Culverts (cmp)	0.025
Unlined Disturbed Area Ditches	0.035

2.4 Drainage Areas

All drainage areas were planimetered directly from either Plate 7-1, "Permit Area Hydrology Map", and Plate 7-2, "Disturbed Area Hydrology/Watershed".

2.5 Slopes, Lengths

All slopes and lengths were measured directly from the topography on Plates 7-1 and 7-2.

2.6 Runoff Volume

Runoff was calculated using the SCS Formula for NOAA Type II, 24-hour storms; using the Storm Version 6.21 computer program:

$$Q = \frac{(P - 0.2\,S)^2}{P + 0.8\,S}$$

where:

CN	=	Runoff Curve Number
Q	=	Runoff in inches
P	=	Precipitation in inches
S	=	$\frac{1000}{CN} - 10$

2.7 Runoff Curve Numbers

Two curve numbers were utilized for the undisturbed areas. Areas with milder slopes (less than 30%) were given a runoff curve number of 75. All other undisturbed areas (30% slope or greater) were given a runoff curve number of 83. These numbers were taken directly from the approved "Mining and Reclamation Plan, Horse Canyon Mine, Emery County, Utah, Volume III", submitted by I.P.A. The numbers in that plan were based on vegetation and soils data from on-site.

Two other runoff curve numbers have been used in the calculations. A runoff CN of 90 is used for all disturbed areas (including the areas designated as undisturbed which lie within the disturbed area boundary (See Plate 7-2), and a runoff CN of 95 is used for paved areas. These numbers are based on commonly used and approved values and from Table 2.20, (p. 82, Barfield, et al, 1983).

The following is a summary of runoff curve numbers used in these calculations:

Watershed	Runoff CN
Undisturbed (<30% slopes):	75
Undisturbed (>30% slopes):	83
Disturbed:	90
Paved:	95

2.8 Culvert Sizing

Minimum culvert sizing is based on the either the inlet control nomograph or Manning's Equation. Culverts were evaluated for inlet control conditions to determine the minimum pipe size using the Culvert Nomograph included as Figure 1 of this Appendix. If the pipe had a HW/D ratio equal to or greater than 1.0 or the slope were less than 2% the Haestad Methods, Flowmaster, Version 6.0 computer program was used to determine the pipe flow diameter using:

$$D = \left(\frac{2.16\ Q\ n}{\sqrt{s}}\right)^{0.35}$$

where:	D	=	Required Diameter (feet)
	Q	=	QP = Peak Discharge (cfs)
	n	=	Roughness Factor (0.025 for CMP)
	S	=	Slope (ft. per ft.)

2.9 Culverts

Culverts have been sized according to the calculations previously described, and are shown on Plate 7-5, "Proposed Sediment Control Map". Culverts carrying undisturbed drainages are designated with UC- Letters (i.e. UC-1). All undisturbed area drainage culverts will be fitted with trash racks to minimize plugging by rocks or other debris.

Trash racks will be provided at the inlet for all undisturbed drainage culverts. These will consist of 3/4" steel bars welded on 6" centers across the flared inlet structures of each culvert. Bars will be sloped from the front of the inlet structure up to the top of the culvert. This ramp configuration will allow trash, branches and other potential obstructions to be swept up and away from the inlet rather than being impinged against the grates during a flow event. Rip rap will be placed around the flared inlet structure and above it to a height of at least 6" above the required headwall for each culvert. (See Figure 4 for details). Trash racks will be checked on a routine schedule and following precipitation events and all trash, branches and other obstructions will be removed.

It should be noted that all undisturbed area culverts are adequately sized to handle the expected runoff from a <u>100 year - 6 hour event</u> for maximum protection of the mine area, sediment pond and undisturbed drainage. This is well in excess of the 10 year - 6 hour event required by the regulations and is proposed as an extra measure of safety.

Disturbed area culverts and ditches are shown on the "Sediment Control Map", Plate 7-5. Culverts carrying disturbed drainage are designated with a DC-number (i.e. DC-1). Calculations for all disturbed area culverts and ditches are also included with this report, along with design criteria. Disturbed drainage areas draining to culverts and ditches are marked with a DA-number (i.e. DA-1). Undisturbed drainage areas are marked with a UA-number (i.e. UA-1).

Culverts will be inspected regularly, and cleaned as necessary to provide for passage of drainage flows. Inlets and outlets shall also be maintained so as to prevent plugging or undue restriction of water flow.

All disturbed area culverts are temporary, and will be removed upon final reclamation.

2.10 Main Canyon Culvert - Outlet Structure

The outlet of culvert UC-1 has been designed to flow onto a rip-rap apron to protect against souring and to allow for energy dissipation. The rip-rap apron is designed to fit the natural channel configuration as closely as possible, and will allow runoff to re-enter the natural channel at a reduced velocity which is no greater than natural flow conditions. Runoff from the 100 year - 6 hour precipitation event in the canyon below the minesite has been calculated at 52.32 cfs, including sediment pond overflow.

The rip-rap apron design is based on Figure 7-26, Design of Outlet Protection - Maximum Tailwater Condition, "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983. Based on the figure, the apron should be a minimum of 15' in length, widening from 5' to 9', with a 0.1% slope. The proposed length has been increased to 20', to ensure adequate time for velocity reduction. The apron slope is kept at 0.1%. Rip-rap size is conservatively placed at 12" D_{50}. Rip-rap will be placed to a depth of 1.5 D_{50} and will be placed on a 6" layer of 2" drain rock filter. Rip-rap will also be placed on the 2H:1V side slopes to the height of the culvert (5') at the culvert outlet tapering to 3' at the outlet of the apron. This rip-rap apron has been sized and designed to adequately dissipate energy from flow velocities of a 100 year - 6 hour precipitation event and resist dislodgement. The drain rock filter bed will also serve to secure the rip-rap boulders firmly in place, to add an additional element of stability, and prevent scouring underneath the armored apron. (See Figure 4A for construction details). The natural channel below the culvert has a gradient of approximately 7.76%. When the flow is routed from the culvert across the apron to the natural channel, the velocity is reduced from 4.79 fps at the culvert outlet to 1.50 fps at the outlet of the apron. (See Culvert Outlet Rip-Rap Apron Flow Velocity Calculations in Appendix 1.)

It should be noted that these calculations are based on a <u>100 year - 6 hour event</u>.

2.11 Ditches

All ditches will carry disturbed area drainage to the pond. Ditches are shown on the Proposed Sediment Control Map, Plate 7-5, and are designated with a DD-number (i.e. DD-1 for Disturbed Area Ditches) or UD-number (i.e. UD-1 for Undisturbed Area Ditches).

All ditches are designed to carry the expected runoff from a 10 year - 6 hour event with a minimum freeboard of 0.5' (See Table 8 and Figure 3).

Ditches which exhibit expected flow velocities of 5 fps or greater will be lined with rip-rap. A typical cross-section is shown on Figure 3 and flow depths and areas for all lined and unlined ditches are presented in Table 8 of this report.

Ditch slopes have been determined from Plates 7-2 and 7-5.

All ditches will be inspected regularly, and maintained to the minimum dimensions to provide adequate capacity for the design flow. All ditches are temporary and will be removed as described under the reclamation hydrology section. (Section 4)

TABLE 1

Undisturbed Watershed Summary		
Watershed	Drains To	Final
UA-1	UC-1	Right Fork Lila Canyon
UA-2	DD-2	Sediment Pond
UA-4	Sediment Pond	Sediment Pond
UA-5	DD-20	Sediment Pond
UA-6a	DD-12	Sediment Pond
UA-6b	DD-11	Sediment Pond
UA-8	ASCA Area	Left Fork Lila Canyon

TABLE 2

Disturbed Watershed Summary		
Watershed	Drains To	Final
DA-1a	DD-1a	Sediment Pond
DA-1b	DD-1b	Sediment Pond
DA-1c	DD-1c	Sediment Pond
DA-2a	DD-2a	Sediment Pond
DA-2b	DD-2b	Sediment Pond
DA-2c	DD-2c	Sediment Pond
DA-3	DD-3	Sediment Pond
DA-4a	DD-4a	Sediment Pond
DA-4b	DD-4b	Sediment Pond
DA-4c	DD-4c	Sediment Pond
DA-5a	DD-5a	Sediment Pond
DA-5b	DD-5b	Sediment Pond
DA-5c	DD-5c	Sediment Pond
DA-6a	DD-6a	Sediment Pond
DA-6b	DD-6b	Sediment Pond
DA-6c	DD-6c	Sediment Pond
DA-7	DD-7	Sediment Pond
DA-8a	DD-8a	Sediment Pond
DA-8b	DD-8b	Sediment Pond
DA-8c	DD-8c	Sediment Pond
DA-9	DD-9	Sediment Pond
DA-10	DD-10	Sediment Pond
DA-11	DD-11	Sediment Pond
DA-13a	DD-13a	Sediment Pond
DA-13b	DD-13d	Sediment Pond
DA-13c	DD-13e	Sediment Pond
UA-5 (future)	DD-20	Sediment Pond
DA-14a	DD-14a	Sediment Pond 2
DA-14b	DD-14b	Sediment Pond 2
DA-15a	DD-15a	Sediment Pond 2
DA-15b	DD-15b	Sediment Pond 2
DA-16a	DD-16a	Sediment Pond 2
DA-16b	DD-16b	Sediment Pond 2
DA-17a	DD-17a	Sediment Pond 2
DA-17b	DD-17b	Sediment Pond 2
DA-18a	DD-18a	Sediment Pond 2
DA-18b	DD-18b	Sediment Pond 2
Fan Portal	ASCA Area	Right Fork Lila Canyon
TS-1	Topsoil Berm	Sediment Pond
POND	Sediment Pond	Sediment Pond

TABLE 3

Watershed	Area (Acre)	Hydraulic Length (ft.)	Elevation Change (ft.)	% Slope	CN
Watershed Parameters					
Undisturbed Watersheds					
UA-1	248.82	9475	2020	21.31	75
UA-2	10.01	1500	1000	66.67	83
UA-4	14.08	1950	595	30.51	83
UA-5	2.64	650	35	5.38	90
UA-6a	1.50	230	80	34.78	90
UA-6b	0.40	90	30	33.33	90
UA-8	0.37	100	30	30.00	90
Disturbed Watersheds					
DA-1a	0.33	680	152	22.35	95
DA-1b	0.31	420	48	11.43	95
DA-1c	0.20	225	20	8.89	95
DA-2a	0.93	680	162	23.82	95
DA-2b	0.14	350	36	10.29	95
DA-2c	0.10	106	16	15.10	95
DA-3	0.30	170	16	9.41	90
DA-4a	0.14	100	12	12.00	95
DA-4b	0.12	270	28	10.37	95
DA-4c	0.60	580	54	9.31	95
DA-5a	0.07	180	24	13.33	95
DA-5b	0.33	125	14	11.20	90
DA-5c	0.42	570	54	9.47	95
DA-6a	0.28	200	54	27.00	90
DA-6b	3.35	760	70	9.21	90
DA-6c	2.51	690	70	10.14	90
DA-7	2.68	630	30	4.76	95
DA-8a	0.26	284	54	19.01	90
DA-8b	0.76	670	52	7.80	90
DA-8c	0.95	410	42	10.24	90
DA-9	0.05	50	6	12.00	95
DA-10	2.89	700	20	2.86	95
DA-11	0.78	340	16	4.70	95
DA-13a	1.97	470	12	2.55	95
DA-13b	0.49	280	4	1.43	90
DA-13c	0.40	460	22	4.78	90

TABLE 3 (Continued)

Watershed Parameters					
Watershed	Area (Acre)	Hydraulic Length (ft.)	Elevation Change (ft.)	% Slope	CN
Disturbed Watersheds					
DA-14a	0.36	390	34	8.71	95
DA-14b	0.75	540	16	2.96	95
DA-15a	0.38	525	50	9.52	95
DA-15b	0.62	270	12	4.44	95
DA-16a	0.16	370	10	2.70	95
DA-16b	0.09	210	13	6.19	95
DA-17a	0.42	610	19	3.11	95
DA-17b	0.07	100	5	5.00	95
DA-18a	0.07	175	6	3.43	95
DA-18b	0.44	650	24	3.69	95
Fan Portal	0.60	195	25	12.80	90
TS-1	2.95	660	38	5.75	83
POND	1.92	380	50	13.16	95

TABLE 4

Runoff Summary Undisturbed Watersheds (Not Draining to Ponds)					
Watershed	10 yr. / 6 hr. Peak Flow - cfs	25 yr. / 6 hr. Peak Flow - cfs	100 yr. / 6 hr. Peak Flow - cfs	10 yr. / 24 hr. Peak Flow - cfs	10 yr. / 24 hr. Volume - ac.ft.
UA-1	7.03	10.33	20.47	25.45	6.91
UA-8	0.14	0.18	0.26	0.14	0.03

TABLE 5

Runoff Summary Watershed Drainage to Sediment Pond				
Watershed	10 yr. / 6 hr. Peak Flow-cfs	25 yr. / 6 hr. Peak Flow-cfs	10 yr. / 24 hr. Peak Flow-cfs	10 yr. / 24 hr. Volume-ac-ft
Undisturbed Watersheds draining to Pond #1				
UA-2	2.11	3.11	6.11	0.52
UA-4	3.14	4.65	9.20	0.74
UA-5	1.28	1.64	2.41	0.22
UA-6a	0.47	0.60	0.95	0.12
UA-6b	0.10	0.13	0.21	0.03
Disturbed Watersheds draining to Pond #1				
DA-1a	0.22	0.26	0.37	0.04
DA-1b	0.20	0.24	0.33	0.04
DA-1c	0.11	0.14	0.19	0.02
DA-2a	0.61	0.73	1.03	0.11
DA-2b	0.09	0.10	0.15	0.02
DA-2c	0.04	0.05	0.08	0.01
DA-3	0.11	0.14	0.21	0.03
DA-4a	0.06	0.08	0.11	0.02
DA-4b	0.07	0.08	0.12	0.01
DA-4c	0.42	0.51	0.71	0.07
DA-5a	0.05	0.06	0.09	0.01
DA-5b	0.11	0.14	0.21	0.03
DA-5c	0.29	0.35	0.49	0.05
DA-6a	0.09	0.12	0.18	0.02
DA-6b	1.60	2.06	3.27	0.28
DA-6c	1.18	1.52	2.40	0.21
DA-7	1.98	2.39	3.36	0.31
DA-8a	0.10	0.12	0.19	0.02
DA-8b	0.36	0.47	0.74	0.06
DA-8c	0.40	0.52	0.81	0.08
DA-9	0.04	0.05	0.07	0.01
DA-10	2.19	2.65	3.73	0.33
DA-11	0.52	0.63	0.89	0.09
DA-13a	1.46	1.76	2.47	0.23
DA-13b	0.23	0.30	0.47	0.04
DA-13c	0.19	0.24	0.38	0.03
TS-1	0.65	0.96	1.90	0.15
POND	1.18	1.42	1.99	0.22
TOTAL		28.22		4.17

TABLE 5 (Continued)

Runoff Summary Watershed Drainage to Sediment Pond				
Watershed	10 yr. / 6 hr. Peak Flow-cfs	25 yr. / 6 hr. Peak Flow-cfs	10 yr. / 24 hr. Peak Flow-cfs	10 yr. / 24 hr. Volume-ac-ft
Disturbed Watersheds not draining to Pond #1				
Fan Portal	0.21	0.27	0.40	0.43
Disturbed Watersheds draining to Pond #2				
DA-14a	0.23	0.28	0.39	0.04
DA-14b	0.56	0.67	0.95	0.09
DA-15a	0.26	0.31	0.44	0.04
DA-15b	0.40	0.48	0.67	0.07
DA-16a	0.11	0.14	0.19	0.02
DA-16b	0.06	0.07	0.10	0.01
DA-17a	0.31	0.38	0.53	0.05
DA-17b	0.05	0.06	0.09	0.01
DA-18a	0.06	0.07	0.10	0.01
DA-18b	0.33	0.40	0.56	0.05
TOTAL		2.86		0.39

TABLE 6

Runoff Control Structure Watershed Summary		
Structure	Type	Contributing Watersheds/Structures
UC-1	Culvert	UA-1, Fan Portal, Sediment Pond Overflow
DD-1a	Ditch	DA-1a
DD-1b	Ditch	DD-1a, DA-1b, UA-6b
DC-2	Culvert	DD-1b
DD-1c	Ditch	DC-2, DA-1c
DD-2a	Ditch	DA-2a, UA-2
DD-2b	Ditch	DD-2a, DA-2b
DC-1	Culvert	DD-2b, UA-2
DD-2c	Ditch	DC-1, DA-2c
DC-3	Culvert	DD-2c
DD-3	Ditch	DA-3
DC-4	Culvert	DD-3
DD-4a	Ditch	DA-4a
DD-4b	Ditch	DD-4a, DC-4, DA-4b
DC-20	Culvert	DD-4b
DD-4c	Ditch	DC-20, DA-4c
DC-9	Culvert	DD-4c
DD-5a	Ditch	DA-5a
DD-5b	Ditch	DD-5a, DA-5b
DC-5	Culvert	DD-5b
DD-5c	Ditch	DC-5, DA-5c
DC-10	Culvert	DD-5c, DC-9
DD-6a	Ditch	DC-3, DD-1c, DA-6a
DC-6	Culvert	DD-6a

TABLE 6

Runoff Control Structure Watershed Summary		
Structure	Type	Contributing Watersheds/Structures
DD-6b	Ditch	DC-6, DA-6b
DD-6c	Ditch	DA-6c
DC-8	Culvert	DD-6b, DD-6c
DD-7	Ditch	DA-7
DC-7	Culvert	DD-7
DD-8a	Ditch	DA-8a
DD-8b	Ditch	DD-8a, DC-7, DA-8b
DD-8c	Ditch	DD-8b, DC-8*, DA-8c
DD-9	Ditch	DC-10, DD-5c, DA-9
DC-11	Culvert	DD-9
DD-10	Ditch	DA-10
DC-12	Culvert	DD-10
DD-11	Ditch	DA-11
DD-12	Ditch	DD-7, UA-6a
DD-13a	Ditch	DC-11, DA-13a
DD-13b	Ditch	DD-13a, DD-11
DD-13c	Ditch	DD-13b, DC-12
DD-13d	Ditch	DD-13c, DD-8c, DD-13b
DC-13	Culvert	DD-13d
DD-13e	Ditch	DC-13, DA-13c
DD-14a	Ditch	DA-14a
DD-14b	Ditch	DA-14b
DC-14	Culvert	DD-14a, DD-14b
DD-15a	Ditch	DA-15a

TABLE 6

Runoff Control Structure Watershed Summary		
Structure	Type	Contributing Watersheds/Structures
DD-15b	Ditch	DD-15a, DA-15b
DC-19	Culvert	DD-15b
DD-16a	Ditch	DA-16a
DC-15	Culvert	DD-16a
DD-16b	Ditch	DC-15, DA-16b
DD-17a	Ditch	DA-17a
DC-16	Culvert	DD-17a
DD-17b	Ditch	DC-16, DC-14, DA-17b
DC-17	Culvert	DD-17b, DD-16b
DD-18a	Ditch	DA-18a
DC-18	Culvert	DD-18a
DD-18b	Ditch	DC-18, DA-18b
DD-20	Ditch	DC-8, UA-5*

DD-12 & 19 do not exist.

* DD-20 receives discharge from DC-8 during high flows which may overflow DD-8b and DD-8c and UA-5

TABLE 7

Runoff Control Structure
Flow Summary

Structure	Type	10yr. / 6hr. Peak Flow-cfs	10yr. / 24hr. Peak Flow-cfs	25yr. / 6hr. Peak Flow-cfs	100yr. / 6hr. Peak Flow-cfs
UC-1*	Culvert	35.46	54.07	38.82	49.09
DD-1a	Ditch	0.22	0.37	0.26	- -
DD-1b	Ditch	0.52	0.91	0.63	- -
DC-2	Culvert	0.52	0.91	0.63	- -
DD-1c	Ditch	0.63	1.10	0.77	- -
DD-2a	Ditch	2.72	7.14	3.84	- -
DD-2b	Ditch	2.81	7.29	3.94	- -
DC-1	Culvert	2.81	7.29	3.94	- -
DD-2c	Ditch	2.85	7.37	3.99	- -
DC-3	Culvert	2.85	7.37	3.99	- -
DD-3	Ditch	0.11	0.21	0.14	- -
DC-4	Culvert	0.11	0.21	0.14	- -
DD-4a	Ditch	0.06	0.11	0.08	- -
DD-4b	Ditch	0.24	0.44	0.30	- -
DC-20	Culvert	0.24	0.44	0.30	- -
DD-4c	Ditch	0.66	1.15	0.81	- -
DC-9	Culvert	0.66	1.15	0.81	- -
DD-5a	Ditch	0.05	0.09	0.06	- -
DD-5b	Ditch	0.16	0.30	0.20	- -
DC-5	Culvert	0.16	0.30	0.20	- -
DD-5c	Ditch	0.45	0.79	0.55	- -
DC-10	Culvert	1.11	1.94	1.36	- -
DD-6a	Ditch	2.94	7.55	4.11	- -
DC-6	Culvert	2.94	7.55	4.11	- -

TABLE 7

Runoff Control Structure Flow Summary					
Structure	Type	10yr. / 6hr. Peak Flow-cfs	10yr. / 24hr. Peak Flow-cfs	25yr. / 6hr. Peak Flow-cfs	100yr. / 6hr. Peak Flow-cfs
DD-6b	Ditch	4.54	10.82	6.17	- -
DD-6c	Ditch	1.18	2.40	1.52	- -
DC-8	Culvert	5.72	13.22	7.69	- -
DD-7	Ditch	2.45	4.31	2.99	- -
DC-7	Culvert	2.45	4.31	2.99	- -
DD-8a	Ditch	0.10	0.19	0.12	- -
DD-8b	Ditch	2.91	5.24	3.58	- -
DD-8c	Ditch	6.12	14.03	8.21	- -
DD-9	Ditch	0.04	2.80	1.96	- -
DC-11	Culvert	1.60	2.80	1.96	- -
DD-10	Ditch	2.19	3.73	2.65	- -
DC-12	Culvert	2.19	3.73	2.65	- -
DD-11	Ditch	0.52	0.89	0.63	- -
DD-13a	Ditch	3.06	5.27	3.72	- -
DD-13b	Ditch	3.58	6.16	4.35	- -
DD-13c	Ditch	5.77	9.89	7.00	- -
DD-13d	Ditch	6.35	14.50	8.51	- -
DC-13	Culvert	6.35	14.50	8.51	- -
DD-13e	Ditch	6.54	14.88	8.75	- -
DD-14a	Ditch	0.23	0.39	0.28	- -
DD-14b	Ditch	0.56	0.95	0.67	- -
DC-14	Culvert	0.79	1.34	0.95	- -
DD-15a	Ditch	0.26	0.44	0.31	- -
DD-15b	Ditch	0.66	1.11	0.79	- -

TABLE 7

Runoff Control Structure Flow Summary					
Structure	Type	10yr. / 6hr. Peak Flow-cfs	10yr. / 24hr. Peak Flow-cfs	25yr. / 6hr. Peak Flow-cfs	100yr. / 6hr. Peak Flow-cfs
DC-19	Culvert	0.66	1.11	0.79	- -
DD-16a	Ditch	0.11	0.19	0.14	- -
DC-15	Culvert	0.11	0.19	0.14	- -
DD-16b	Ditch	0.17	0.29	0.21	- -
DD-17a	Ditch	0.31	0.53	0.38	- -
DC-16	Culvert	0.31	0.53	0.38	- -
DD-17b	Ditch	1.15	1.96	1.39	- -
DC-17	Culvert	1.32	2.25	1.60	- -
DD-18a	Ditch	0.06	0.10	0.07	- -
DC-18	Culvert	0.06	0.10	0.07	- -
DD-18b	Ditch	0.39	0.66	0.47	- -
DD-20	Ditch	5.72	13.22	7.69	- -

DD-12 & 19 do not exist.

* UC-1flow values includes sum of peak flows for UA-1 from Table 4 and 25yr-6hr Sediment Pond 1 peak flow of 28.22 cfs & Fan Portal flow from Table 5.

TABLE 8						
Disturbed Ditch Design Summary						
Ditch	DD-1a	DD-1b	DD-1c	DD-2a	DD-2b	DD-2c
Slope (%)	11.42	11.20	10.00	12.06	10.29	14.29
Length (ft.)	683	420	20	680	350	105
Manning's No.	0.035	0.035	0.035	0.035	0.035	0.035
Side Slope (H:V)	2:1	2:1	2:1	2:1	2:1	2:1
*Bottom Width (ft.)	0.00	0.00	0.00	2.00	2.00	2.00
Peak Flow 10/6 (cfs)	0.22	0.52	0.63	2.72	2.81	2.85
Peak Flow 10/24 (cfs)	0.37	0.91	1.10	7.14	7.29	7.37
Flow Depth (ft.) 10/6	0.20	0.27	0.30	0.23	0.24	0.22
Flow Depth (ft.) 10/24	0.24	0.34	0.37	0.39	0.42	0.38
Flow Area (ft.^{2}) 10/6	0.08	0.15	0.18	0.56	0.61	0.55
Flow Area (ft.^{2}) 10/24	0.11	0.23	0.27	1.10	1.18	1.06
Velocity (fps) 10/6	2.84	3.49	3.51	4.81	4.61	5.18
Velocity (fps) 10/24	3.23	4.02	4.04	6.49	6.18	6.96
Rip-Rap Req'd (Y/N)	N	N	N	N	N	Y
Rip-Rap D_{50}	-	-	-	-	-	6"
Note: Slope/Lengths from Plate 7-2.						

TABLE 8 (Continued)

Disturbed Ditch Design Summary							
Ditch	DD-3	DD-4a	DD-4b	DD-4c	DD-5a	DD-5b	DD-5c
Slope (%)	0.60	11.00	10.26	10.00	13.11	11.11	9.52
Length (ft.)	171	100	273	580	183	126	567
Manning's No.	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Side Slope (H:V)	2:1	2:1	2:1	2:1	2:1	2:1	2:1
*Bottom Width (ft.)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peak Flow 10/6 (cfs)	0.11	0.06	0.24	0.66	0.05	0.16	0.45
Peak Flow 10/24 (cfs)	0.21	0.11	0.44	1.15	0.09	0.30	0.79
Flow Depth (ft.) 10/6	0.26	0.12	0.21	0.30	0.11	0.18	0.27
Flow Depth (ft.) 10/24	0.34	0.15	0.26	0.38	0.14	0.22	0.33
Flow Area (ft.^{2}) 10/6	0.14	0.03	0.09	0.19	0.02	0.06	0.14
Flow Area (ft.^{2}) 10/24	0.23	0.05	0.14	0.28	0.04	0.10	0.22
Velocity (fps) 10/6	0.79	2.02	2.79	3.55	2.06	2.59	3.17
Velocity (fps) 10/24	0.93	2.35	3.24	4.08	2.39	3.04	3.65
Rip-Rap Req'd (Y/N)	N	N	N	N	N	N	N
Rip-Rap D_{50}	-	-	-	-	-	-	-
Note: Slope/Lengths from Plate 7-2.							

TABLE 8 (Continued)

Disturbed Ditch Design Summary							
Ditch	DD-6a	DD-6b	DD-6c	DD-7	DD-8a	DD-8b	DD-8c
Slope (%)	18.00	2.56	3.38	1.08	20.42	7.81	10.34
Length (ft.)	200	507	532	370	284	666	406
Manning's No.	0.040	0.035	0.035	0.035	0.035	0.035	0.040
Side Slope (H:V)	2:1	2:1	2:1	2:1	2:1	2:1	2:1
*Bottom Width (ft.)	3.00	1.00	1.00	1.00	0.00	1.00	2.00
Peak Flow 10/6 (cfs)	2.94	4.54	1.18	2.45	0.10	2.91	6.12
Peak Flow 10/24 (cfs)	7.55	10.82	2.40	4.31	0.19	5.24	14.03
Flow Depth (ft.) 10/6	0.19	0.60	0.28	0.55	0.13	0.37	0.41
Flow Depth (ft.) 10/24	0.32	0.90	0.41	0.72	0.17	0.49	0.63
Flow Area ($ft.^2$) 10/6	0.62	1.32	0.45	1.15	0.03	0.63	1.14
Flow Area ($ft.^2$) 10/24	1.17	2.52	0.75	1.75	0.06	0.98	2.07
Velocity (fps) 10/6	4.71	3.43	2.64	2.12	2.90	4.59	5.35
Velocity (fps) 10/24	6.47	4.29	3.21	2.46	3.40	5.37	6.78
Rip-Rap Req'd (Y/N)	Y	N	N	N	N	N	Y
Rip-Rap D_{50}	6"	-	-	-	-	-	6"
Note: Slope/Lengths from Plate 7-2.							

TABLE 8 (Continued)

Disturbed Ditch Design Summary							
Ditch	DD-9	DD-10	DD-11	DD-13a	DD-13b	DD-13c	DD-13d
Slope (%)	10.00	3.02	5.06	2.53	3.23	3.30	1.25
Length (ft.)	50	696	336	474	62	38	278
Manning's No.	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Side Slope (H:V)	2:1	2:1	2:1	2:1	2:1	2:1	2:1
*Bottom Width (ft.)	0.00	1.00	0.00	1.00	1.00	1.00	3.00
Peak Flow 10/6 (cfs)	0.04	2.19	0.52	3.06	3.58	5.77	6.35
Peak Flow 10/24 (cfs)	0.07	3.73	0.89	5.27	6.16	9.89	14.50
Flow Depth (ft.) 10/6	0.11	0.40	0.32	0.50	0.51	0.63	0.57
Flow Depth (ft.) 10/24	0.13	0.53	0.39	0.65	0.66	0.82	0.89
Flow Area ($ft.^2$) 10/6	0.02	0.73	0.20	0.99	1.02	1.44	2.36
Flow Area ($ft.^2$) 10/24	0.03	1.08	0.30	1.48	1.52	2.15	4.25
Velocity (fps) 10/6	1.76	3.00	2.59	3.08	3.51	4.01	2.69
Velocity (fps) 10/24	2.03	3.46	2.97	3.55	4.05	4.61	3.41
Rip-Rap Req'd (Y/N)	N	N	N	N	N	N	N
Rip-Rap D_{50}	-	-	-	-	-	-	-
Note: Slope/Lengths from Plate 7-2.							

TABLE 8 (Continued)

Disturbed Ditch Design Summary							
Ditch	DD-13e	DD-14a	DD-14b	DD-15a	DD-15b	DD-16a	DD-16b
Slope (%)	4.78	8.72	3.15	9.70	4.07	2.97	6.06
Length (ft.)	460	390	540	525	270	370	165
Manning's No.	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Side Slope (H:V)	2:1	2:1	2:1	2:1	2:1	2:1	2:1
*Bottom Width (ft.)	3.00	0.00	0.00	0.00	0.00	0.00	0.00
Peak Flow 10/6 (cfs)	6.54	0.23	0.56	0.26	0.66	0.11	0.17
Peak Flow 10/24 (cfs)	14.88	0.39	0.95	0.44	1.11	0.19	0.29
Flow Depth (ft.) 10/6	0.40	0.21	0.36	0.22	0.36	0.20	0.20
Flow Depth (ft.) 10/24	0.63	0.26	0.43	0.26	0.44	0.24	0.25
Flow Area ($ft.^2$) 10/6	1.52	0.09	0.25	0.09	0.26	0.08	0.08
Flow Area ($ft.^2$) 10/24	2.68	0.13	0.38	0.14	0.38	0.12	0.12
Velocity (fps) 10/6	4.31	2.59	2.21	2.78	2.54	1.44	2.10
Velocity (fps) 10/24	5.54	2.96	2.52	3.18	2.89	1.65	2.40
Rip-Rap Req'd (Y/N)	N	N	N	N	N	N	N
Rip-Rap D_{50}	-	-	-	-	-	-	-
Note: Slope/Lengths from Plate 7-2.							

TABLE 8 (Continued)

Disturbed Ditch Design Summary							
Ditch	DD-17a	DD-17b	DD-18a	DD-18b	DD-20		
Slope (%)	2.68	4.12	2.86	3.54	4.88		
Length (ft.)	485	97	175	650	737		
Manning's No.	0.035	0.035	0.035	0.035	0.035		
Side Slope (H:V)	2:1	2:1	2:1	2:1	2:1		
*Bottom Width (ft.)	0.00	0.00	0.00	0.00	0.00		
Peak Flow 10/6 (cfs)	0.31	1.15	0.06	0.39	5.72		
Peak Flow 10/24 (cfs)	0.53	1.96	0.10	0.66	13.22		
Flow Depth (ft.) 10/6	0.29	0.44	0.16	0.30	0.78		
Flow Depth (ft.) 10/24	0.36	0.54	0.19	0.37	1.07		
Flow Area (ft.^{2}) 10/6	0.17	0.39	0.05	0.18	1.23		
Flow Area (ft.^{2}) 10/24	0.26	0.59	0.07	0.27	2.30		
Velocity (fps) 10/6	1.80	2.93	1.22	2.11	4.66		
Velocity (fps) 10/24	2.05	3.35	1.39	2.41	5.75		
Rip-Rap Req'd (Y/N)	N	N	N	N	N		
Rip-Rap D_{50}	-	-	-	-	-		
Note: Slope/Lengths from Plate 7-2.							

TABLE 9

Disturbed Culvert Design Summary						
Culvert	DC-1	DC-2	DC-3	DC-4	DC-5	DC-6
Slope (%)	13.33	10.77	3.03	21.50	12.00	5.00
Length (ft.)	30	65	33	135	50	80
Manning's No.	0.025	0.025	0.025	0.025	0.025	0.025
Peak Flow 10/6 (cfs)	2.81	0.52	2.85	0.11	0.16	2.94
Peak Flow 10/24 (cfs)	7.29	0.91	7.37	0.21	0.30	7.55
Diam. Proposed (ft.)	1.50	1.50	1.50	1.50	1.50	2.00
Velocity (fps) 10/24	10.72	5.31	5.94	4.35	3.95	7.27
Rip-Rap D_{50}	6"	6"	6"	N/A	N/A	6"
Note: Slope/Lengths from Plate 7-5. Velocity: (Haestad Methods, Flowmaster, Version 6.0)						

TABLE 9 (Continued)

Disturbed Culvert Design Summary						
Culvert	DC-7	DC-8	DC-9	DC-10	DC-11	DC-12
Slope (%)	46.40	38.80	5.70	14.25	4.60	4.00
Length (ft.)	110	85	35	55	65	50
Manning's No.	0.025	0.025	0.025	0.025	0.025	0.025
Peak Flow 10/6 (cfs)	2.45	5.72	0.66	1.11	1.60	2.19
Peak Flow 10/24 (cfs)	4.31	13.22	1.15	1.94	2.80	3.73
Diam. Proposed (ft.)	1.50	2.00	1.50	1.50	1.50	1.50
Velocity (fps) 10/24	14.05	17.69	4.55	7.33	5.44	5.60
Rip-Rap D_{50}	12"	12"	N/A	6"	6"	6"
Note: Slope/Lengths from Plate 7-5. Velocity: (Haestad Methods, Flowmaster, Version 6.0)						

TABLE 9 (Continued)

Disturbed Culvert Design Summary						
Culvert	DC-13	DC-14	DC-15	DC-16	DC-17	DC-18
Slope (%)	3.33	3.33	3.33	3.33	4.00	5.70
Length (ft.)	30	60	60	60	75	35
Manning's No.	0.025	0.025	0.025	0.025	0.025	0.025
Peak Flow 10/6 (cfs)	6.35	0.79	0.11	0.31	1.32	0.06
Peak Flow 10/24 (cfs)	14.50	1.34	0.19	0.53	2.25	0.10
Diam. Proposed (ft.)	2.00	1.50	1.50	1.50	1.50	1.50
Velocity (fps) 10/24	7.34	3.93	2.20	2.99	4.87	2.19
Rip-Rap D_{50}	6"	N/A	N/A	N/A	N/A	N/A
Note: Slope/Lengths from Plate 7-5. Velocity: (Haestad Methods, Flowmaster, Version 6.0)						

TABLE 9 (Continued)

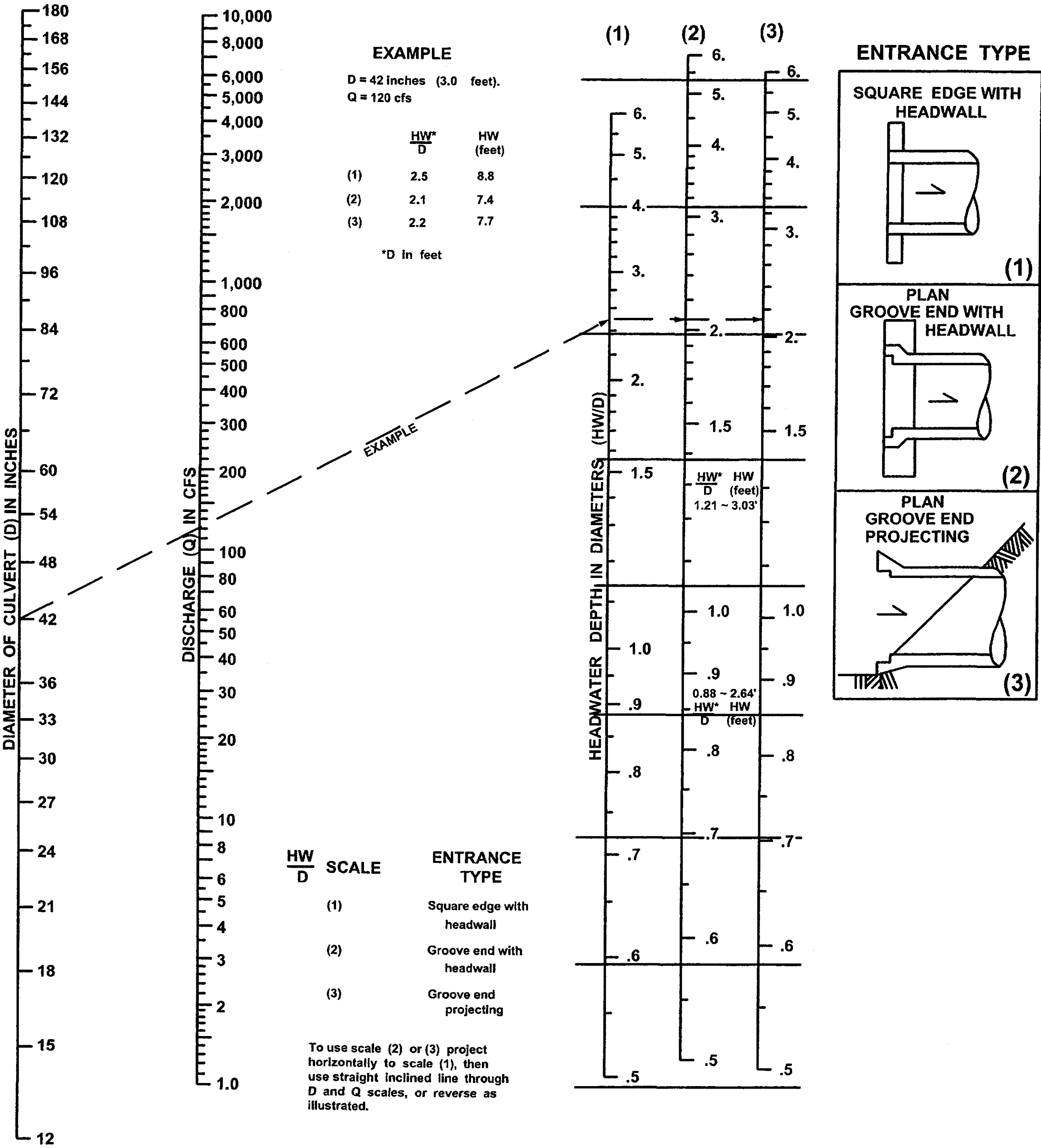
Disturbed Culvert Design Summary						
Culvert	DC-19	SP2-1				
Slope (%)	2.50	0.50				
Length (ft.)	40	165				
Manning's No.	0.025	0.025				
Peak Flow 10/6 (cfs)	0.66	-				
Peak Flow 10/24 (cfs)	1.11	2.86*				
Diam. Proposed (ft.)	1.50	1.50				
Velocity (fps) 10/24	3.36	2.39				
Rip-Rap D_{50}	N/A	N/A				

Note: Slope/Lengths from Plate 7-5.
* SP2-1 Peak Flow is a 25/6 event
Source: (Haestad Methods, Flowmaster, Version 6.0)

TABLE 10

Undisturbed Culvert Design Summary		
Culvert	UC-1	
Min. Slope (%)**	0.50	
Length (ft.)	480	
Manning's No.	0.025	
Peak Flow 10/6 (cfs)*	35.46	
Peak Flow 100/6 (cfs)*	49.09	
Diam. Proposed (ft.)	5.00	
Velocity (fps) 100/6	4.91	

* Note: Peak flow values include 25 year-6 hour flow from Sediment Pond 1 (see Tables 4 and 7).
** Pipe slope from Plate 7-6a.

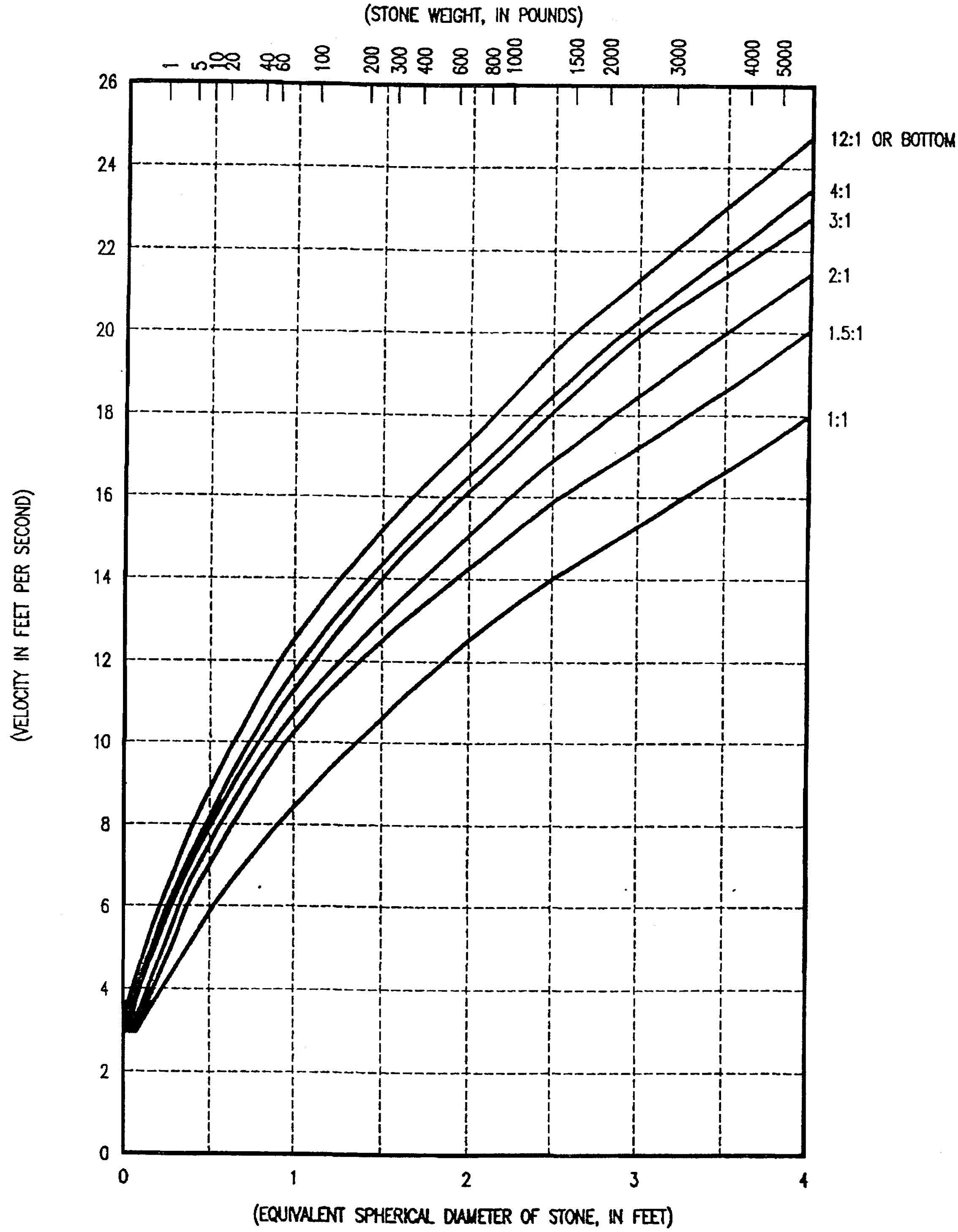


Headwater Depth for Smooth Interior Pipe Culverts with Inlet Control

0' NTS

FIGURE 1. HEADWATER DEPTH NOMOGRAPH

RIP-RAP CHART

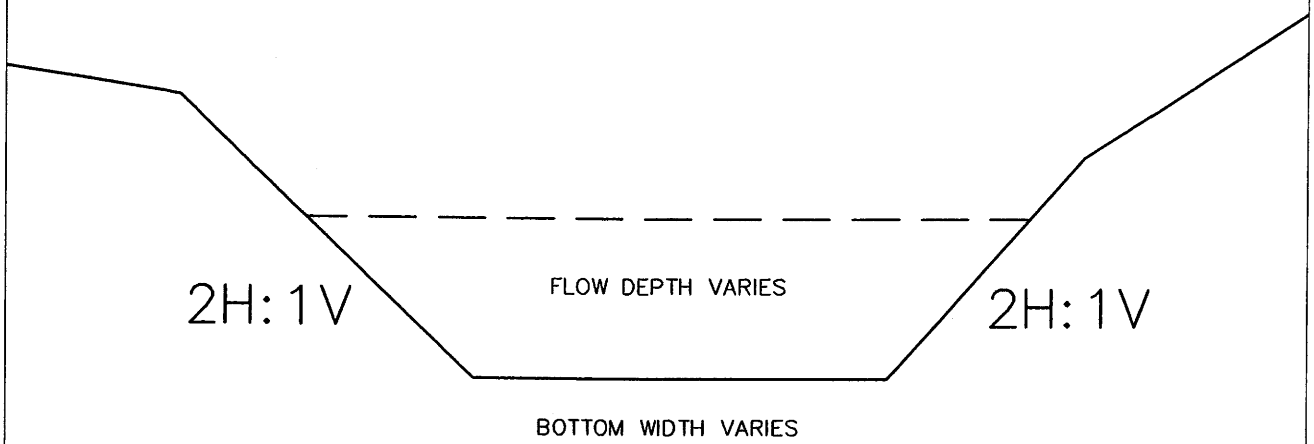


SIZE OF STONE THAT WILL RESIST DISPLACEMENT FOR VARIOUS VELOCITIES AND SIDE SLOPES

NOTE:

ADAPTED FROM REPORT OF SUBCOMMITTE ON SLOPE PROTECTION, AM. SOC. CIVIL ENGINEERS PROC. JUNE 1948.
FOR STONE WEIGHING 165 LBS. PER CUBIC FEET.

Figure 2

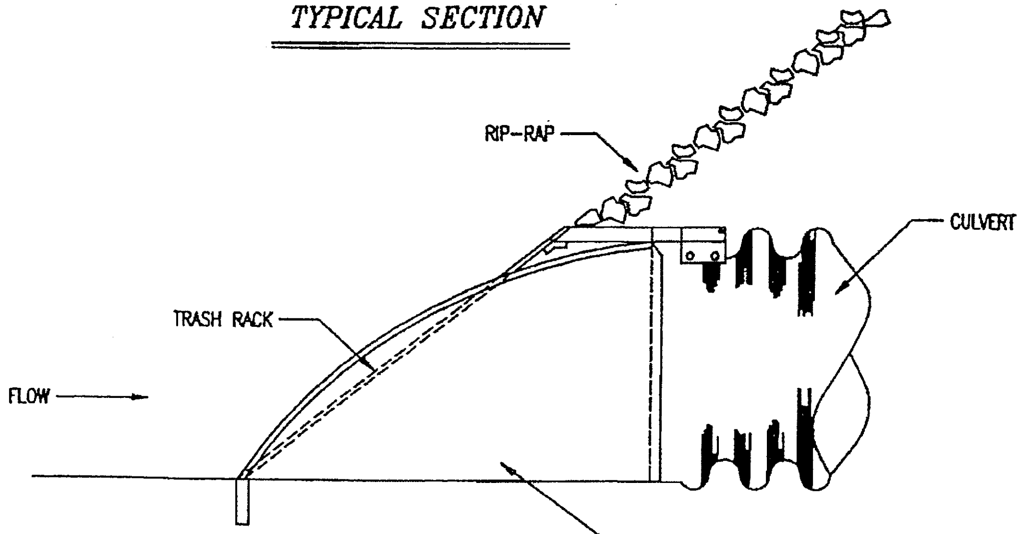


APPENDIX 7-4, TABLE 8 PRESENTS THE SPECIFIC DETAILS OF DITCH SIZING

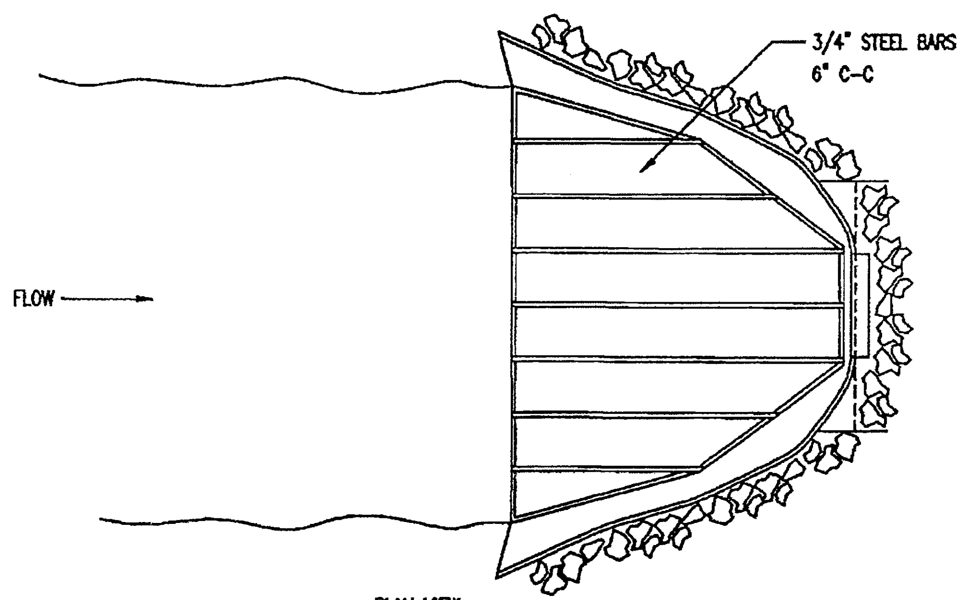
0' NTS

FIGURE 3. DISTURBED DITCH TYPICAL SECTION

UNDISTURBED CULVERT INLET
TYPICAL SECTION



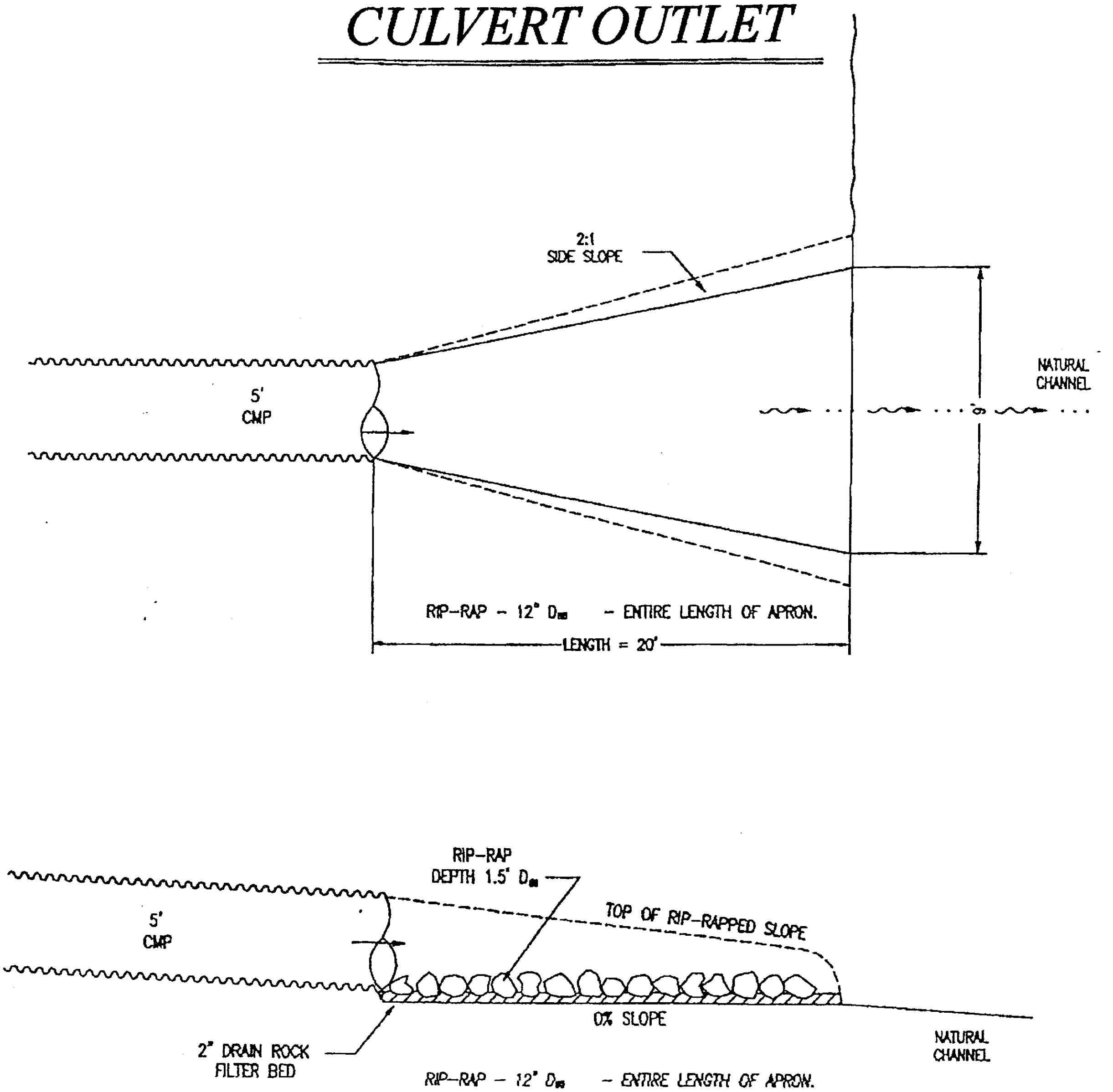
SIDE VIEW



PLAN VIEW

Figure 4

UC-1
CULVERT OUTLET



* DESIGN BASED ON FIGURE 7-26, DESIGN OF OUTLET PROTECTION - MAXIMUM TAILWATER CONDITION, "APPLIED HYDROLOGY AND SEDIMENTOLOGY FOR DISTURBED AREAS", BARFIELD, WARNER & HAAN, 1983.

UTAH REGISTERED PROFESSIONAL ENGINEER #154168 DAN W. GUY 9/11/00

Figure 4A

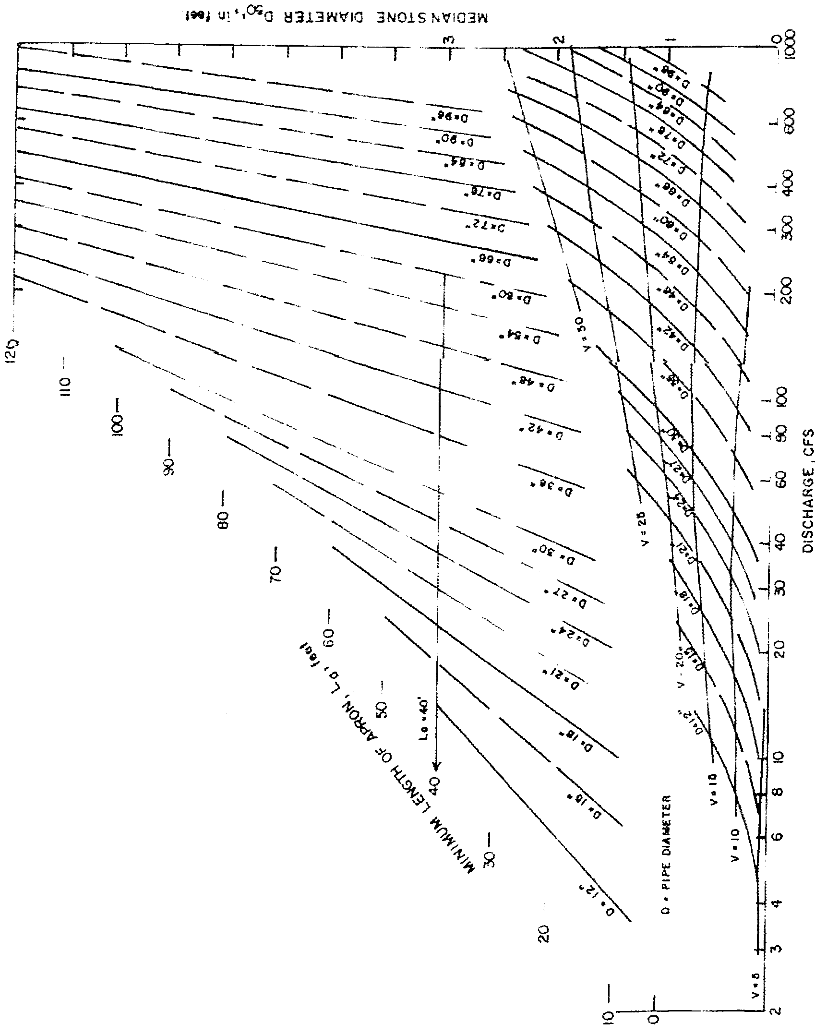


Figure 7.26. Design of outlet protection - maximum tailwater condition, $T_W \geq 0.5$ D. (U.S. EPA, 1976)

DESIGN OF SEDIMENT CONTROL STRUCTURES

Design Specifications:

3.1	Design and Construction Specifications for Sedimentation Pond
3.2	Sediment Yield
3.3	Sediment Pond Volume
3.4	Sediment Pond Summary

Tables:

Table 11	Sediment Pond Design
Table 12a	Sediment Pond #1 - Stage Volume Data
Table 12b	Sediment Pond #2 - Stage Volume Data
Table 13a	Sediment Pond #1 - Stage Discharge Data
Table 13b	Sediment Pond #2 - Stage Discharge Data

Figures:

Figure 5.4	Depth of 2-year, 6-hour rainfall - Barfield et al.
Figure 5.15	Slope-effect Chart - Barfield et al.

3.1 Design and Construction Specifications for Sedimentation Pond

a) All construction of sedimentation ponds will be performed under the direction of a qualified, registered professional engineer.

b) The sediment pond #1 will be located in an existing low area where the Right Fork of Lila Canyon passes beneath the existing road. The existing road fill and culvert will be removed, and the pond embankment (road fill) will be reconstructed and compacted. The existing culvert will be replaced with UC-1 which will extend approximately 300' up the Right Fork of Lila Canyon. This culvert will be equipped with an inlet section and trash rack, and will allow undisturbed runoff and treated access road drainage to pass beneath the sediment pond. The majority of the pond will be in an existing channel area, and is therefore considered incised. The pond will be equipped with a culvert riser principal spillway with an oil skimmer, a decant, and a second culvert riser emergency spillway with an oil skimmer. Both spillways will discharge to the oversized (60") CMP culvert running beneath the pond.

c) The area of pond constructed shall be examined for topsoil, and where present in removable quantities, such soil shall be removed separately and stored in an approved topsoil storage location.

d) In areas where fill is to be placed for the pond impoundment structures, natural ground shall be removed to at least 12" below the base of the structure.

e) Native materials shall be used where practical. Fill will be placed in lifts not to exceed 6" and compacted prior to placement of next lift. Compaction of all fill materials shall be at least 95%.

f) Rip-rap or other protection (culverts, concrete, etc.) will be placed at all pond inlets to prevent scouring. Rip-rap will consist of substantial, angular (non-slaking) rock material of adequate size.

g) Decanting of the pond, as required, will be accomplished by use of a decant pipe with an inverted inlet as shown on Plate 7-6. Samples will be collected prior to decanting of the pond. If the quality of the water meets the requirements of the U.P.D.E.S. Permit, decanting will proceed. Discharge samples will be collected as per the approved U.P.D.E.S. Discharge Permit.

h) Slopes of the embankments shall not be steeper than 2h:1v, inside or outside, with a total of the inslope and outslope not less than 5h:1v, except where areas of the pond are incised.

i) External slopes of the impoundment will be planted with an approved seed mix to help prevent erosion and promote stability.

j) Top width of the embankment shall be not less than (H+35)/5, where H = Height of Dam in feet.

3.2 Sediment Yield

The Universal Soil Equation (USLE) was used to estimate sediment yield from disturbed areas. All soil loss from this area was assumed to be delivered to, and deposited in the sedimentation pond.

Erosion rate (A) in tons-per-acre-per-year is determined using the USLE as follows:

$$A = (R)\,(K)\,(LS)\,(CP)$$

Where the variables R, K, LS, and CP are defined as follows:

Variable "R" is the rainfall factor which can be estimated from $R = 27P^{2.2}$; where P is the 2-year, 6-hour precipitation value. P for the Lila Canyon area is 0.75" as shown in Figure 5.4, page 315, Barfield, et.al. 1983. Therefore, the estimated value of "R" for this area is 14.34.

Variable "K" is the soil erodibility factor. For disturbed areas, the "K" value is conservatively estimated to be 0.5. For disturbed runoff, but uncompacted and ungraded areas, "K" is estimated at 0.320. "K" is estimated to be 0.035 for undisturbed areas.

Variable "LS" is the length-slope factor. This figure was determined by applying the slope length and percentage for each sub-drainage area to the chart in Figure 5.15, p. 334, "Applied Hydrology and Sedimentology for Disturbed Areas", Barfield, Warner and Haan, 1983.

Variable "CP" is the control practice factor, which can be divided into a cover and practice factor. Values were determined from Appendix 5A, Barfield, et.al., 1983.

Site	CP Factor
Compacted Areas	1.20
Disturbed/Uncompacted Areas	0.20
Undisturbed Areas	0.15

The sediment volume is based on a density of 100 pounds per cubic foot of sediment.

SEDIMENT YIELD CALCULATIONS - USLE - Sediment Pond #1

Drainage	R	K	Acres	Slope Length Feet	Slope (%)	LS	CP	A	Yield
DA-1a	14.34	0.500	0.33	680	22.35	12.50	1.20	107.55	0.0163
DA-1b	14.34	0.500	0.31	420	11.43	3.30	1.20	28.39	0.0040
DA-1c	14.34	0.500	0.20	225	8.89	1.70	1.20	14.63	0.0013
DA-2a	14.34	0.500	0.93	680	23.82	13.00	1.20	111.85	0.0478
DA-2b	14.34	0.500	0.14	350	10.29	2.80	1.20	24.09	0.0015
DA-2c	14.34	0.500	0.10	106	15.10	2.60	1.20	22.37	0.0010
DA-3	14.34	0.500	0.30	170	9.41	1.60	1.20	13.77	0.0019
DA-4a	14.34	0.500	0.14	100	12.00	1.80	1.20	15.49	0.0010
DA-4b	14.34	0.500	0.12	270	10.37	2.40	1.20	20.65	0.0011
DA-4c	14.34	0.500	0.60	580	9.31	2.70	1.20	23.23	0.0064
DA-5a	14.34	0.500	0.07	180	13.33	2.80	1.20	24.09	0.0008
DA-5b	14.34	0.500	0.33	125	11.20	1.80	1.20	15.49	0.0023
DA-5c	14.34	0.500	0.42	570	9.47	3.00	1.20	25.81	0.0050
DA-6a	14.34	0.500	0.28	200	27.00	9.50	1.20	81.74	0.0105
DA-6b	14.34	0.500	3.35	710	9.21	3.20	1.20	27.53	0.0423
DA-6c	14.34	0.500	2.51	690	10.14	3.60	1.20	30.97	0.0357
DA-7	14.34	0.500	2.68	630	4.76	1.25	1.20	10.76	0.0132
DA-8a	14.34	0.500	0.26	284	19.01	4.80	1.20	41.30	0.0049
DA-8b	14.34	0.500	0.76	670	7.80	2.40	1.20	20.65	0.0072
DA-8c	14.34	0.500	0.95	410	10.24	2.80	1.20	24.09	0.0105
DA-9	14.34	0.500	0.05	50	12.00	1.35	1.20	11.62	0.0003
DA-10	14.34	0.500	2.89	700	2.86	0.43	0.01	0.03	0.0000
DA-11	14.34	0.500	0.78	340	4.70	0.85	1.20	7.31	0.0026
DA-13a	14.34	0.500	1.97	470	2.55	0.38	0.01	0.03	0.0000
DA-13b	14.34	0.500	0.49	280	1.43	0.22	1.20	1.89	0.0004
DA-13c	14.34	0.500	0.40	460	4.78	1.05	1.20	9.03	0.0017
UA-2	14.34	0.500	10.01	1500	66.67	75.00	0.15	80.66	0.3707
UA-4	14.34	0.500	14.08	1950	47.76	50.00	0.15	53.78	0.3476
UA-6a	14.34	0.500	1.45	230	34.70	15.00	0.15	16.13	0.0107
UA-6b	14.34	0.500	0.40	90	33.33	9.00	0.15	9.68	0.0018

Total Sediment 1 year (ac.ft.) 0.9491

Total Sediment 3 years (ac. ft.) 2.8473

* Disturbed Runoff / Uncompacted Area
** Paved Areas

SEDIMENT YIELD CALCULATIONS - USLE - Sediment Pond #2

Drainage	R	K	Acres	Slope Length Feet	Slope (%)	LS	CP	A	Yield
DA-14a	14.34	0.500	0.36	390	8.71	2.25	1.20	19.36	0.0032
DA-14b	14.34	0.500	0.75	540	2.96	0.44	1.20	3.79	0.0013
DA-15a	14.34	0.500	0.38	525	9.52	3.40	1.20	29.25	0.0051
DA-15b	14.34	0.500	0.62	270	4.44	0.62	1.20	5.33	0.0015
DA-16a	14.34	0.500	0.16	370	2.70	0.38	1.20	3.27	0.0002
DA-16b	14.34	0.500	0.09	210	6.19	1.05	1.20	9.03	0.0004
DA-17a	14.34	0.500	0.42	610	3.11	0.50	1.20	4.30	0.0008
DA-17b	14.34	0.500	0.07	100	5.00	0.54	1.20	4.65	0.0002
DA-18a	14.34	0.500	0.07	175	3.43	0.40	1.20	3.44	0.0001
DA-18b	14.34	0.500	0.44	650	3.69	0.65	1.20	5.59	0.0011
Total									0.014

Total Sediment 1 year (ac.ft.) 0.014

Total Sediment 3 years (ac. ft.) 0.042

* Disturbed Runoff / Uncompacted Area

** Paved Areas

3.3 Sediment Pond Volume

The volumes shown in Tables 11a and 11b are from the volumes calculated from the precipitation, runoff and sediment yield for a 10 year-24 hour precipitation event. The volumes were calculated based on the disturbed areas (and contributing undisturbed areas) runoff values, developed using the design parameters described in this section.

TABLE 11a

Sediment Pond #1 Design	
1. Use 1.90" for 10 year - 24 hour event.	
2. Runoff Volume - (4.17 ac-ft, from Table 5, 10yr/24hr Vol) =	4.17 ac-ft (1)
3. Sediment Storage Volume USLE 0.9491 ac-ft./yr. x 2 yrs. =	1.90 ac-ft
4. Total Required Pond Volume 4.17 + 1.90 =	6.07 ac-ft
5. Peak Flow (25 yr. - 6 hr. event) =	28.22 cfs (2)
6. Pond Design Volume @ Principle Spillway = (See Table 12a)	8.060 ac-ft

(1) This includes flow from UA-5 within mine boundary. There is a possibility that this undisturbed area may be needed if the surface facilities were to be expanded.

(2) This is to allow for flow from UA-5. There is a possibility that UA-5 may be needed if the surface facilities were to be expanded.

TABLE 12a

Sediment Pond #1 Stage/Volume Data				
Elevation	Area (sq. ft.)	Volume (sq. ft.)	Acc. Volume (ac. ft.)	Remarks
5829	0	0	0.00	Bottom of Pond
5830	5740	2870	0.07	
5831	17190	11465	0.33	
5832	23370	20280	0.79	
5833	26160	24765	1.36	
5834	28250	27025	1.99	Sediment Cleanout Level 5833.6
5835	30120	29185	2.66	Decant 5834.6 - 2.52 ac-ft
5836	32020	31070	3.37	
5837	34020	33020	4.13	Detention Storage - 4.17 ac-ft
5838	36060	35040	4.93	
5839	38160	37110	5.79	
5840	40330	39245	6.69	Principal Spillway
5841	42620	41475	7.64	Emergency Spillway
5842	44910	43765	8.64	
5843	47160	46035	9.70	Top of Embankment

TABLE 11b

Sediment Pond #2 Design	
1. Use 1.90" for 10 year - 24 hour event.	
2. Runoff Volume - (from Table 5, 10yr/24hr) =	0.39 ac-ft.
3. Sediment Storage Volume USLE 0.014 ac-ft./yr. x 3 yrs. =	0.04 ac-ft
4. Total Required Pond Volume 0.39 + 0.04 =	0.43 ac-ft
5. Peak Flow (25 yr. - 6 hr. event)* =	2.86 cfs
6. Pond Design Volume @ Principle Spillway = (See Table 12b)	1.08 ac-ft
* Peak Flow values from Table 5, sum of all contributing watersheds.	

TABLE 12b

Sediment Pond #2 Stage/Volume Data				
Elevation	Area (sq. ft.)	Volume (sq. ft.)	Acc. Volume (ac. ft.)	Remarks
5833.35	0	0	0.00	Bottom of Pond
5834	220	70	0.003	
5835	1100	660	0.02	
5835.5			0.04	Sediment Cleanout Level
5836	5420	2860	0.08	Decant
5838	6780	6495	0.36	
5840	7890	7610	0.69	
5841	8470	8175	0.88	
5842	9050	8755	1.08	Principal Spillway
5843	9660	9350	1.30	Emergency Spillway
5844	10270	9960	1.52	
5844.5	10500	5190	1.64	Top of Embankment

TABLE 13a

Sediment Pond #1 Stage/Discharge Data			
Head (ft.)	Q (cfs) Weir Controlled	Q (cfs) Orfice Controlled	Q (cfs) Pipe Flow Controlled
0.0	-	-	-
0.2	2.53	15.22	95.68
0.4	7.15	21.53	96.23
0.6	13.14	26.36	96.77
0.8	20.23	30.44	97.31
1.0	28.27	34.04	97.85
1.2	37.17	37.28	98.38
1.4	46.84	40.27	98.91
1.6	57.22	43.05	98.91
1.8	68.28	45.66	99.44
2.0	79.97	48.13	99.97

Note: 1- 25 year - 6 hour flow = 28.22 cfs.
2- Flow will be weir controlled at a head of 0.99' over riser inlet.

Weir Controlled

$Q = CLH^{1.5}$; where: C= 3.0, L= Circumference of Riser = 9.4248', R=1.5'

Orfice Controlled

$Q = C'a\,(2gH)^{0.5}$; where: C= 0.6, a= Area of Riser = 7.0686 ft^2, R=1.5', g= 32.2 ft/sec^2

Pipe Flow Controlled

$$Q = \frac{a\,(2gH')^{0.5}}{(1+Ke+Kb+KcL)^{0.5}}$$; where

a = Area of Pipe = 7.07 ft^2, R = 1.5'
H' = Head = H + 14.5 (Riser) + 0.35 (Slope) + 0.6*4 (barrel height)
Ke = 1.0
Kb = 0.5
Kc = 0.043
L = 70'

TABLE 13b

Sediment Pond #2 Stage/Discharge Data			
Head (ft.)	Q (cfs) Weir Controlled	Q (cfs) Orfice Controlled	Q (cfs) Pipe Flow Controlled
0.0	-	-	-
0.2	0.84	1.69	5.81
0.4	2.38	2.39	5.88
0.6	4.38	2.93	5.95
0.8	6.74	3.38	6.02
1.0	9.42	3.78	6.09
1.2	12.39	4.14	6.16
1.4	15.61	4.47	6.22
1.6	19.07	4.78	6.29
1.8	22.76	5.07	6.36
2.0	26.66	5.35	6.42

Note: 1- 25 year - 6 hour flow = 2.86 cfs.
2- Flow will be orifice controlled at a head of 0.57' over riser inlet.

Weir Controlled

$Q = CLH^{1.5}$; where: C= 3.0, L= Circumference of Riser =3.14', R=0.5'

Orfice Controlled

$Q = C'a\,(2gH)^{0.5}$; where: C= 0.6, a= Area of Riser = 0.79 ft^2, R=0.5', g= 32.2 ft/sec^2

Pipe Flow Controlled

$$Q = \frac{a\,(2gH')^{0.5}}{(1+Ke+Kb+KcL)^{0.5}}$$

; where
a = Area of Pipe = 0.79 ft^2, R = 0.5'
H' = Head = H + 6.0 (Riser) + 0.8 (Slope) + 0.6*2 (barrel height)
Ke = 1.0
Kb = 0.5
Kc = 0.043
L = 160'

3.4 Sediment Pond Summary

a) The sedimentation ponds have been designed to contain the disturbed area (and contributing undisturbed area) runoff from a 10 year-24 hour precipitation event, along with multiple years of sediment storage capacity. Runoff to the ponds will be directed by various ditches and culverts as described in the plan.

b) The required volume for Sediment Pond #1 is calculated at 6.07 acre feet, including 2 years of sediment storage. The proposed sediment pond size will have a volume of approximately 8.06 acre feet (at the principal spillway), which is more than adequate. The required volume for Sediment Pond #2 is calculated at 0.43 acre feet, including 3 years of sediment storage. The proposed sediment pond size will have a volume of approximately 1.08 acre feet (at the principal spillway), which is more than adequate.

c) The ponds will meet a theoretical detention time of 24 hours. Both are equipped with a decant, a culvert principal spillway and a culvert emergency spillway. Any discharge from the ponds will be in accordance with the approved UPDES Permit.

d) The pond inlets will be protected from erosion, and the spillways will discharge into the natural drainages in a controlled manner.

e) The ponds are temporary, and will be removed upon final reclamation of the property.

f) The ponds will be constructed according to the regulations and under supervision of a Registered, Professional Engineer.

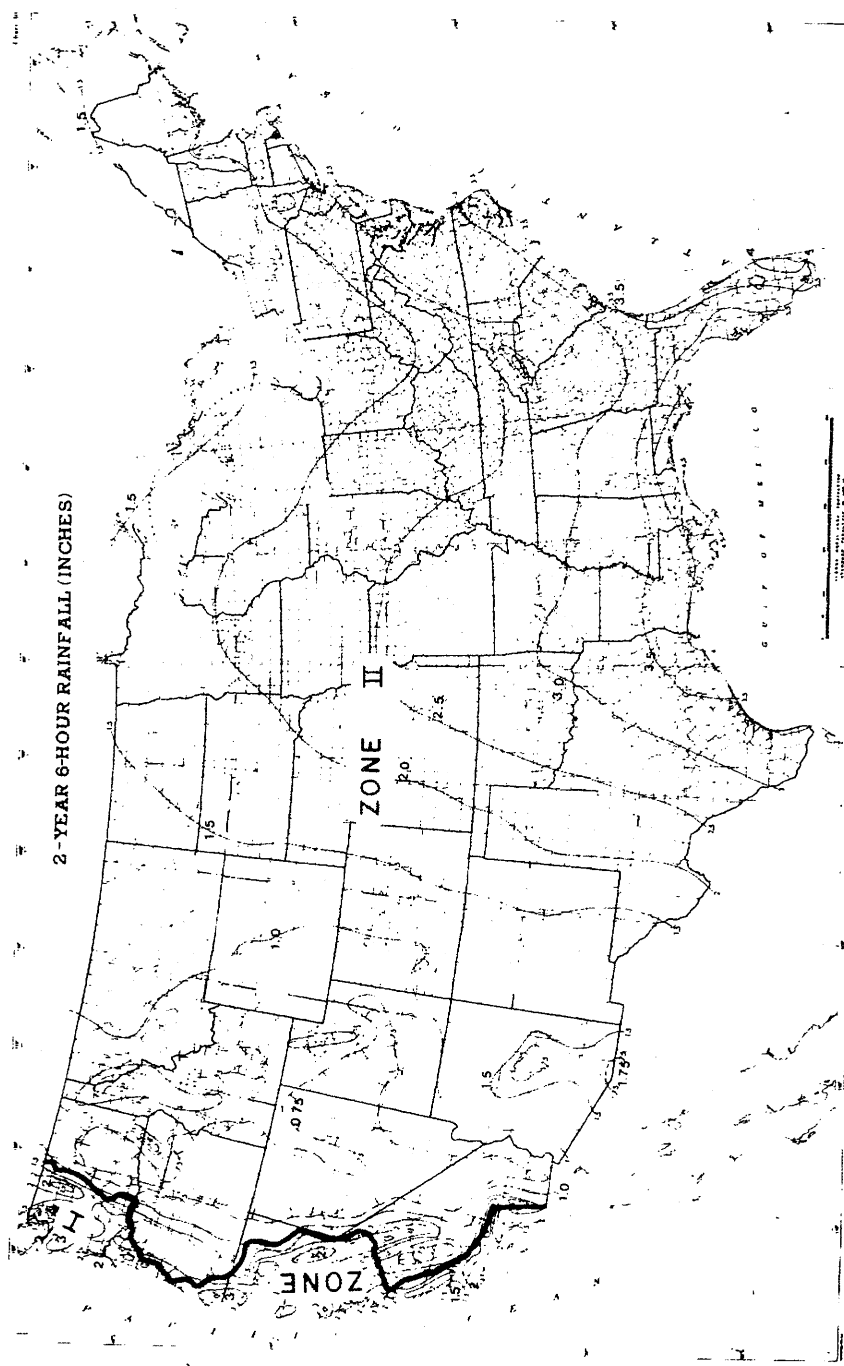
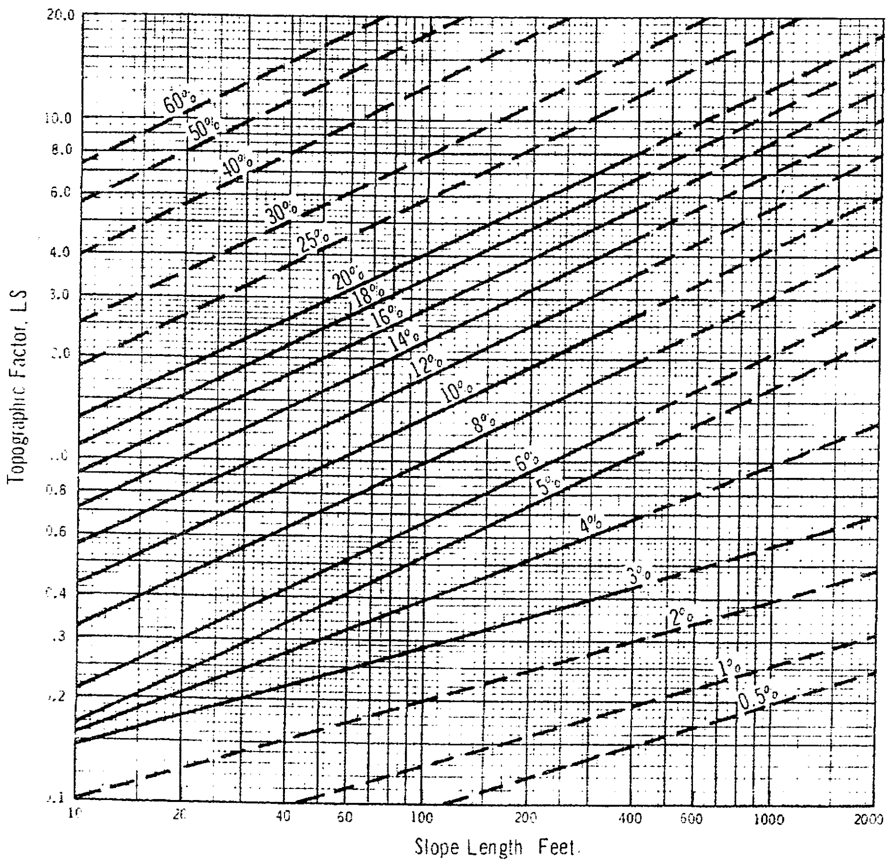


Figure 5.4. Depths of the 2-year, 6-hour rainfall, inches. (Hotes et al., 1973)

where S_j is the slope factor S for the j^{th} segment of the slope given by

$$S_j = \frac{0.43 + 30x_j + 430x_j^{\,2}}{6.613} \tag{5.12}$$



*The dashed lines represent estimates for slope dimensions beyond the range of lengths and steepnesses for which data are available. The curves were derived by the formula:

$$LS = \left(\frac{\lambda}{72.6}\right)^{m} \left(\frac{430x^2 + 30x + 0.43}{6.613}\right)$$

where λ = field slope length in feet and m = 0.5 if s = 5% or greater, 0.4 if s = 4%, and 0.3 if s = 3% or less, and x = sin θ. θ is the angle of slope in degrees.

Figure 5.15. Slope-effect chart (topographic factor, LS). (SCS, 1977)

DESIGN OF DRAINAGE CONTROL STRUCTURES FOR RECLAMATION

Reclamation Hydrology:

Tables:

Figures:

Reclamation Hydrology

4.1 General

Upon completion of operations at the Lila Canyon Minesite, the portals will be sealed and backfilled and all structures will be removed except for the sediment ponds, bypass culvert UC-1, reclamation ditches and temporary sediment controls such as silt fences or straw bales.

Any refuse or mine development waste previously deposited under the approved plan will also be left in place. Concrete will be buried beneath at least 2' of non-toxic, non-acid material. Any potentially toxic or acid-forming material buried on site will be covered with a minimum of 4' of material.

The sediment ponds, and all remaining drainage controls will be removed upon completion of Phase II Bond Release.

4.2 Reclamation Area Drainage Control

During the initial phase of reclamation, all drainage controls will be removed with the exception of the two sediment ponds, bypass culvert UC-1, reclaimed ditches RD-1 and RD-2 and temporary sediment controls such as straw bales or silt fences installed in the undisturbed drainages.

As undisturbed drainage culverts are removed, a minimum of two straw bale or silt fence barriers will be installed downstream of each location for sediment control purposes.

Disturbed areas will be regraded and reclaimed ditches RD-1 and RD-2 will be installed to collect the runoff from the site area and direct it to the outlet structures (see Plate 7-7).

When the vegetation and sediment contribution levels meet requirements for Phase II Bond Release, a series of at least three straw bale or silt fence barriers will be placed downstream of the sediment pond outlets. All upstream sediment controls will be removed. Reclaimed ditches RD-1 and RD-2 will also be removed, regraded and reseeded. Culvert UC-1 will be cut off at the location of the principal pond spillway.

The portion of culvert UC-1 remaining beneath the road will be left as a permanent drainage control. The culvert will be equipped with an inlet section and rip-rapped headwall. The culvert is adequately sized to safely pass runoff from a 100 year - 6 hour event, as shown in Table 10. To ensure that state of the art technology is incorporated, the final reclamation plans for the sedimentation pond areas will be submitted prior to commencement of final reclamation of this area.

The remainder of culvert UC-1 will be removed, and the natural channel restored through the sediment pond #1 area. The sediment pond structures will also be removed, the pond areas regraded as necessary and reseeded. The pond #1 embankment will remain as a permanent feature, since the existing (and proposed future) road through the area passes over the embankment.

Following the successful establishment of vegetation and when effluent standards are met, the sediment ponds will be removed. The same methodologies relative to recontouring, top soil application and seeding will be utilized in grading and revegetating the pond areas as outlined in Chapters 2, 5, and Appendix 5-8.

The pond embankment will be narrowed to facilitate the even character of the Lila Canyon Road. The 60 inch bypass culvert (UC-1) will be removed to within six feet of the road embankment. A newly formed channel will be constructed at an approximate four percent grade to intercept the inlet of the culvert at its intersection of the road. The road embankment and associated new channel will be armored by the Operator with an underlayment of filter gravel, with D_{50} -30 inch rip-rap. The new area of disturbance including the newly formed channel will have top soil spread in and around the rip-rap. The Operator will use the same seeding and mulching methods described in Appendix 5-8 will be used on this area as well. See Figure 4 for a detailed design.

TABLE 14

Final Reclamation Drainage Areas Contributing to Structures	
Channel	Contributing Watershed/Structure
RD-1	RW-1
RD-2	RW-2
UC-1	UA-1, UA-4, RD-1

TABLE 15

Final Reclamation Drainage Structure Flow Summary	
Channel	*100/6 Flow (cfs)
RD-1	13.26
RD-2	10.89
UC-1	**72.62

* CN = 83.
** Combined flow for watersheds UA-1, UA-4, and RW-2.

TABLE 16

Final Reclamation Reclamation Structure Design Parameters					
Channel	Bottom Width (ft.)	Side Slope H:V	Slope %	Reclaimed Depth (ft.)	Manning's No.
RD-1	3	2:1	5.00	1.5	0.035
RD-2	3	2:1	10.00	1.5	0.035
UC-1	60" Diam.	-	0.90*	60" Diam.	0.025

* Pipe slope for Plate 7-6

TABLE 17

Final Reclamation Reclamation Structure Flow Calculations			
Channel	RD-1	RD-2	UC-1
100 year - 6 hour event (in.)	1.90	1.90	1.90
Peak Flow (cfs)	13.26	10.89	72.62
Velocity (fps)	5.44	6.52	6.74
Required Area (ft.^{2})	2.44	1.67	10.80
Flow Depth (ft.)	0.58	0.43	2.69

Alternate Sediment Control for Fan Site and Topsoil Storage Area

5.1 ASCA Areas

Sediment Control at the fan, slope below water treatment area, and topsoil storage area sites will be accomplished with a combination of one or more of the following: berms, silt fences, and straw bales.

The topsoil collected from the fan and topsoil storage area sites will be located downslope from the sites and will be used in the construction of the berm. The berm will be constructed a minimum of two feet high and have 2:1 side slopes. The berm will control the flow from a 10 year-24 hour precipitation event. Silt fence will be selectively placed to help control run-off. The berm will be stabilized with vegetation to prevent erosion. As much as practical, the vegetation techniques used on the main topsoil pile will be utilized on the fan topsoil berm.

The outside of the berm will be protected with a silt fence or gravel. The gravel, if used, would help augment the revegetation. Construction details of the silt fence/filter fence are shown if Figure 5.

The outslope of the portal access road and the outslope of the water treatment pad will have a silt fence located along the disturbed area boundary to treat the runoff from the slope. While some portions of this area will be disturbed as a result of the fill material placed for the pad and road construction, the major portion of this area is expected to remain undisturbed. As an added protection, the portions of the area that are disturbed by the fill placement will be covered with a erosion control mat to minimize the erosion from this slope and that area seeded to aid in the establishment of a vegetative cover.

Due to lack of final engineering details, the exact location of the berms, silt fences, and subsequent erosion techniques will be determined in field with the approval of UDOGM. The final determination will be made prior to the start of topsoil removal.

Run-off Calculations

5.2 Fan Site

Acreage:	0.716 acres
Design Storm:10 year/24 hour:	1.90"
CN:	90
S:	1.111

$$Q=\frac{(P-0.25S)^2}{P+0.8S} = 1.01\text{" of runoff}$$

Total run-off = 0.06 acre feet

5.3 Topsoil Storage Area

Acreage:	2.61 acres
Design Storm: 10 year/24 hour:	1.90"
CN:	90
S:	1.111

$$Q = \frac{(P-0.25S)^2}{P+0.8S} = 1.01\text{" of runoff}$$

Total run-off = 0.22 acre feet

5.4 Water Treatment Area

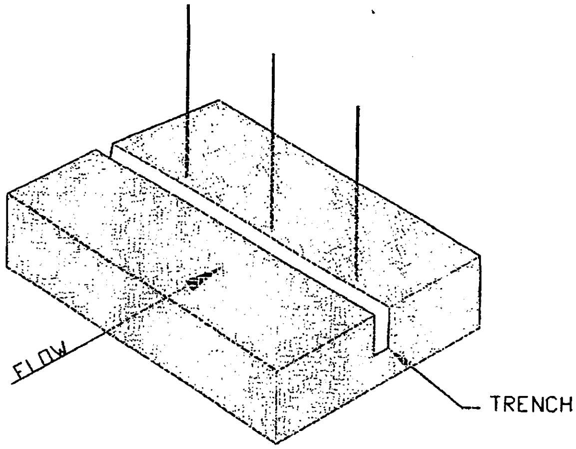
Acreage:	0.37 acres
Design Storm: 10 year/24 hour:	1.90"
CN:	90
S:	1.111

$$Q = \frac{(P-0.2S)^2}{P+0.8S} = 1.01\text{" of runoff}$$

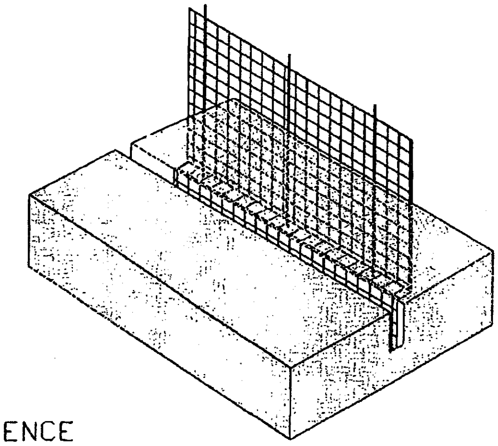
Total run-off = 0.03 acre feet

FILTER FENCE CONSTRUCTION

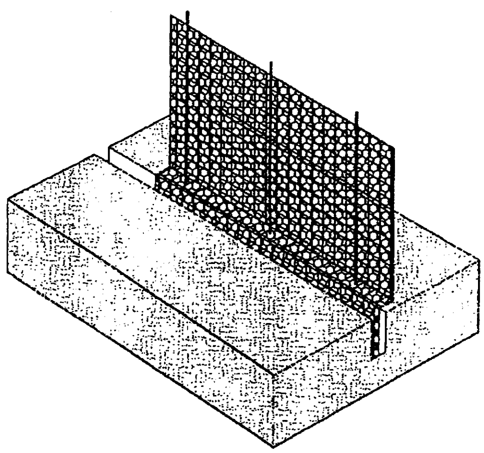
1. SET POSTS, EXCAVATE TRENCH



2. TIE WIRE FENCING TO POST



3. ATTACH FILTER FABRIC TO WIRE FENCE WIRE AND FABRIC EXTENDS INTO TRENCH



4. BACKFILL AND COMPACT SOIL

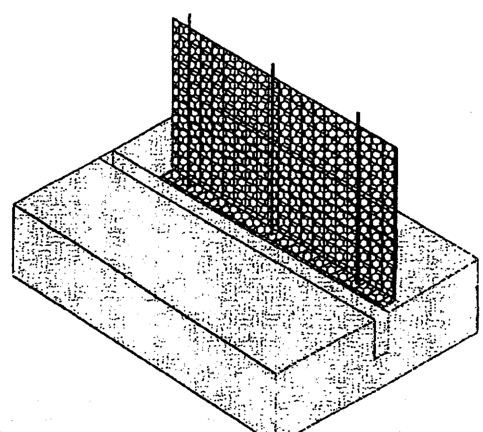


FIGURE 5

Lila Canyon Mine
Watershed Calculations

Project Title = LILA CANYON UA-1 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 75.0

Area = 248.8 acres

Hydraulic length = 9475.00 feet

Elevation change = 2020.0 feet.

Concentration time = 0.27 hours

Unit hydrograph type = Forested

-- Total Area = 248.8 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 7.03 cfs

Discharge volume = 2.10 acre ft

Project Title = LILA CANYON UA-1 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 75.0

Area = 248.8 acres

Hydraulic length = 9475.00 feet

Elevation change = 2020.0 feet.

Concentration time = 0.27 hours

Unit hydrograph type = Forested

-- Total Area = 248.8 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 10.33 cfs

Discharge volume = 3.46 acre ft

Project Title = LILA CANYON UA-1 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 75.0

Area = 248.8 acres

Hydraulic length = 9475.00 feet

Elevation change = 2020.0 feet.

Concentration time = 0.27 hours

Unit hydrograph type = Forested

-- Total Area = 248.8 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 20.47 cfs

Discharge volume = 6.91 acre ft

Project Title = LILA CANYON UA-1 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 75.0

Area = 248.8 acres

Hydraulic length = 9475.00 feet

Elevation change = 2020.0 feet.

Concentration time = 0.27 hours

Unit hydrograph type = Forested

-- Total Area = 248.8 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour design storm

Peak Discharge = 25.45 cfs

Discharge volume = 6.91 acre ft

Project Title = LILA CANYON UA-2 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 10.0 acres

Hydraulic length = 1500.00 feet

Elevation change = 1000.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 10.0 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 2.11 cfs

Discharge volume = 0.23 acre ft

Project Title = LILA CANYON UA-2 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 10.0 acres

Hydraulic length = 1500.00 feet

Elevation change = 1000.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 10.0 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 3.11 cfs

Discharge volume = 0.32 acre ft

Project Title = LILA CANYON UA-2 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 10.0 acres

Hydraulic length = 1500.00 feet

Elevation change = 1000.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 10.0 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 5.35 cfs

Discharge volume = 0.52 acre ft

Project Title = LILA CANYON UA-2 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 10.0 acres

Hydraulic length = 1500.00 feet

Elevation change = 1000.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 10.0 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 6.11 cfs

Discharge volume = 0.52 acre ft

Project Title = LILA CANYON UA-4 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 14.1 acres

Hydraulic length = 1950.00 feet

Elevation change = 595.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 14.1 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 3.14 cfs

Discharge volume = 0.32 acre ft

Project Title = LILA CANYON UA-4 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 14.1 acres

Hydraulic length = 1950.00 feet

Elevation change = 595.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 14.1 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 4.65 cfs

Discharge volume = 0.44 acre ft

Project Title = LILA CANYON UA-4 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 14.1 acres

Hydraulic length = 1950.00 feet

Elevation change = 595.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 14.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 8.04 cfs

Discharge volume = 0.74 acre ft

Project Title = LILA CANYON UA-4 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 14.1 acres

Hydraulic length = 1950.00 feet

Elevation change = 595.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 14.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 9.20 cfs

Discharge volume = 0.74 acre ft

Project Title = Lila Canyon UA-5 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 2.6 acres

Hydraulic length = 650.00 feet

Elevation change = 35.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.6 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.28 cfs

Discharge volume = 0.12 acre ft

Project Title = Lila Canyon UA-5 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 2.6 acres

Hydraulic length = 650.00 feet

Elevation change = 35.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.6 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.64 cfs

Discharge volume = 0.15 acre ft

Project Title = Lila Canyon UA-5 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 2.6 acres

Hydraulic length = 650.00 feet

Elevation change = 35.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.6 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 2.41 cfs

Discharge volume = 0.22 acre ft

Project Title = Lila Canyon UA-5 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 2.6 acres

Hydraulic length = 650.00 feet

Elevation change = 35.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.6 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 2.61 cfs

Discharge volume = 0.22 acre ft

Project Title = LILA CANYON UA-6a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 1.5 acres

Hydraulic length = 230.00 feet

Elevation change = 80.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.5 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.47 cfs

Discharge volume = 0.06 acre ft

Project Title = LILA CANYON UA-6a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 1.5 acres

Hydraulic length = 230.00 feet

Elevation change = 80.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.5 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.60 cfs

Discharge volume = 0.08 acre ft

Project Title = LILA CANYON UA-6a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 1.5 acres

Hydraulic length = 230.00 feet

Elevation change = 80.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.5 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.88 cfs

Discharge volume = 0.12 acre ft

Project Title = LILA CANYON UA-6a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 1.5 acres

Hydraulic length = 230.00 feet

Elevation change = 80.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.5 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.95 cfs

Discharge volume = 0.12 acre ft

Project Title = LILA CANYON UA-6b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 90.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.10 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON UA-6b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 90.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.13 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON UA-6b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 90.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.19 cfs

Discharge volume = 0.03 acre ft

Project Title = LILA CANYON UA-6b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 90.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.21 cfs

Discharge volume = 0.03 acre ft

Project Title = LILA CANYON UA - 7 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type:Null

-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.6 acres
Hydraulic length	=	195.0 Feet
Elevation change	=	25.0 feet
Concentration time	=	0.02 hours
Concentration time type	=	SCS Upland Curves
Unit Hydrograph type	=	Disturbed

-- Total Area = 0.6 acres

-- Storm Data

Total precipitation	=	1.3 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.21 cfs
Discharge volume	=	0.03 acre ft

Project Title = LILA CANYON UA - 7 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type:Null

-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.6 acres
Hydraulic length	=	195.0 Feet
Elevation change	=	25.0 feet
Concentration time	=	0.02 hours
Concentration time type	=	SCS Upland Curves
Unit Hydrograph type	=	Disturbed

-- Total Area = 0.6 acres

-- Storm Data

Total precipitation	=	1.5 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.27 cfs
Discharge volume	=	0.03 acre ft

Project Title = LILA CANYON UA - 7 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type:Null

-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.6 acres
Hydraulic length	=	195.0 Feet
Elevation change	=	25.0 feet
Concentration time	=	0.02 hours
Concentration time type	=	SCS Upland Curves
Unit Hydrograph type	=	Disturbed

-- Total Area = 0.6 acres

-- Storm Data

Total precipitation	=	1.9 inches
Storm type	=	SCS 6 hour design storm
Peak Discharge	=	0.40 cfs
Discharge volume	=	0.05 acre ft

Project Title = LILA CANYON UA - 7 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type:Null

-- Watershed data for watershed # 1

Curve number	=	90.0
Area	=	0.6 acres
Hydraulic length	=	195.0 Feet
Elevation change	=	25.0 feet
Concentration time	=	0.02 hours
Concentration time type	=	SCS Upland Curves
Unit Hydrograph type	=	Disturbed

-- Total Area = 0.6 acres

-- Storm Data

Total precipitation	=	1.9 inches
Storm type	=	SCS Type 2 storm, 24 hour storm
Peak Discharge	=	0.43 cfs
Discharge volume	=	0.03 acre ft

Project Title = LILA CANYON UA-8 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 100.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.14 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON UA-8 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 100.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.18 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON UA-8 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 100.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.26 cfs

Discharge volume = 0.03 acre ft

Project Title = LILA CANYON UA-8 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 100.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 1 storm, 24 hour storm

Peak Discharge = 0.14 cfs

Discharge volume = 0.03 acre ft

Project Title = LILA CANYON DA-1a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.3 acres

Hydraulic length = 680.00 feet

Elevation change = 152.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.22 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON DA-1a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.3 acres

Hydraulic length = 680.00 feet

Elevation change = 152.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.26 cfs

Discharge volume = 0.03 acre ft

Project Title = LILA CANYON DA-1a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.3 acres

Hydraulic length = 680.00 feet

Elevation change = 152.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.35 cfs

Discharge volume = 0.04 acre ft

Project Title = LILA CANYON DA-1a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.3 acres

Hydraulic length = 680.00 feet

Elevation change = 152.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.37 cfs

Discharge volume = 0.04 acre ft

Project Title = LILA CANYON DA-1b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.3 acres

Hydraulic length = 420.00 feet

Elevation change = 48.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.20 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON DA-1b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.3 acres

Hydraulic length = 420.00 feet

Elevation change = 48.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.24 cfs

Discharge volume = 0.03 acre ft

Project Title = LILA CANYON DA-1b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.3 acres

Hydraulic length = 420.00 feet

Elevation change = 48.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.32 cfs

Discharge volume = 0.04 acre ft

Project Title = LILA CANYON DA-1b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.3 acres

Hydraulic length = 420.00 feet

Elevation change = 48.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.33 cfs

Discharge volume = 0.04 acre ft

Project Title = LILA CANYON DA-1c (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.2 acres

Hydraulic length = 225.00 feet

Elevation change = 20.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.11 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-1c (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.2 acres

Hydraulic length = 225.00 feet

Elevation change = 20.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.14 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON DA-1c (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.2 acres

Hydraulic length = 225.00 feet

Elevation change = 20.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.19 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON DA-1c (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.2 acres

Hydraulic length = 225.00 feet

Elevation change = 20.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.19 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON DA-2a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.9 acres

Hydraulic length = 680.00 feet

Elevation change = 162.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.9 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.61 cfs

Discharge volume = 0.06 acre ft

Project Title = LILA CANYON DA-2a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.9 acres

Hydraulic length = 680.00 feet

Elevation change = 162.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.9 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.73 cfs

Discharge volume = 0.08 acre ft

Project Title = LILA CANYON DA-2a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.9 acres

Hydraulic length = 680.00 feet

Elevation change = 162.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.9 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.98 cfs

Discharge volume = 0.11 acre ft

Project Title = LILA CANYON DA-2a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.9 acres

Hydraulic length = 680.00 feet

Elevation change = 162.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.9 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 1.03 cfs

Discharge volume = 0.11 acre ft

Project Title = LILA CANYON DA-2b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 350.00 feet

Elevation change = 36.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.09 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-2b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 350.00 feet

Elevation change = 36.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.10 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-2b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 350.00 feet

Elevation change = 36.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.14 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON DA-2b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 350.00 feet

Elevation change = 36.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.15 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON DA-2c (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 106.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.04 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-2c (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 106.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.05 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-2c (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 106.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.07 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-2c (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 106.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.08 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-3 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 170.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.11 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-3 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 170.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.14 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON DA-3 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 170.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.20 cfs

Discharge volume = 0.03 acre ft

Project Title = LILA CANYON DA-3 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 170.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.21 cfs

Discharge volume = 0.03 acre ft

Project Title = LILA CANYON DA-4a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 100.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.06 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-4a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 100.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.08 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-4a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 100.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.10 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON DA-4a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 100.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.11 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON DA-4b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 270.00 feet

Elevation change = 28.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.07 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-4b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 270.00 feet

Elevation change = 28.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.08 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-4b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 270.00 feet

Elevation change = 28.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.11 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-4b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 270.00 feet

Elevation change = 28.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.12 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-4c (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.6 acres

Hydraulic length = 580.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.6 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.42 cfs

Discharge volume = 0.04 acre ft

Project Title = LILA CANYON DA-4c (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.6 acres

Hydraulic length = 580.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.6 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.51 cfs

Discharge volume = 0.05 acre ft

Project Title = LILA CANYON DA-4c (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.6 acres

Hydraulic length = 580.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.6 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.68 cfs

Discharge volume = 0.07 acre ft

Project Title = LILA CANYON DA-4c (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.6 acres

Hydraulic length = 580.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.6 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.71 cfs

Discharge volume = 0.07 acre ft

Project Title = LILA CANYON DA-5a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 180.00 feet

Elevation change = 24.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.05 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-5a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 180.00 feet

Elevation change = 24.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.06 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-5a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 180.00 feet

Elevation change = 24.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.08 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-5a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 180.00 feet

Elevation change = 24.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.09 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-5b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 125.00 feet

Elevation change = 14.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.11 cfs

Discharge volume = 0.01 acre ft

Project Title = LILA CANYON DA-5b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 125.00 feet

Elevation change = 14.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.14 cfs

Discharge volume = 0.02 acre ft

Project Title = LILA CANYON DA-5b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 125.00 feet

Elevation change = 14.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.20 cfs

Discharge volume = 0.03 acre ft

Project Title = LILA CANYON DA-5b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 125.00 feet

Elevation change = 14.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.21 cfs

Discharge volume = 0.03 acre ft

Project Title = LILA CANYON DA-5c (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 570.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.29 cfs

Discharge volume = 0.03 acre ft

Project Title = LILA CANYON DA-5c (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 570.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.35 cfs

Discharge volume = 0.04 acre ft

Project Title = LILA CANYON DA-5c (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 570.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.47 cfs

Discharge volume = 0.05 acre ft

Project Title = LILA CANYON DA-5c (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 570.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.49 cfs

Discharge volume = 0.05 acre ft

Project Title = Lila Canyon DA-6a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 200.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.09 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-6a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 200.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.12 cfs

Discharge volume = 0.02 acre ft

Project Title = Lila Canyon DA-6a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 200.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.17 cfs

Discharge volume = 0.02 acre ft

Project Title = Lila Canyon DA-6a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 200.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.18 cfs

Discharge volume = 0.02 acre ft

Project Title = Lila Canyon DA-6b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 3.3 acres

Hydraulic length = 760.00 feet

Elevation change = 70.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 3.3 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.60 cfs

Discharge volume = 0.15 acre ft

Project Title = Lila Canyon DA-6b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 3.3 acres

Hydraulic length = 760.00 feet

Elevation change = 70.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 3.3 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 2.06 cfs

Discharge volume = 0.19 acre ft

Project Title = Lila Canyon DA-6b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 3.3 acres

Hydraulic length = 760.00 feet

Elevation change = 70.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 3.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 3.03 cfs

Discharge volume = 0.28 acre ft

Project Title = Lila Canyon DA-6b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 3.3 acres

Hydraulic length = 760.00 feet

Elevation change = 70.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 3.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 3.27 cfs

Discharge volume = 0.28 acre ft

Project Title = Lila Canyon DA-6c (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 2.5 acres

Hydraulic length = 690.00 feet

Elevation change = 70.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.5 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.18 cfs

Discharge volume = 0.11 acre ft

Project Title = Lila Canyon DA-6c (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 2.5 acres

Hydraulic length = 690.00 feet

Elevation change = 70.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.5 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.52 cfs

Discharge volume = 0.14 acre ft

Project Title = Lila Canyon DA-6c (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 2.5 acres

Hydraulic length = 690.00 feet

Elevation change = 70.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.5 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 2.23 cfs

Discharge volume = 0.21 acre ft

Project Title = Lila Canyon DA-6c (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 2.5 acres

Hydraulic length = 690.00 feet

Elevation change = 70.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.5 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 2.40 cfs

Discharge volume = 0.21 acre ft

Project Title = Lila Canyon DA-7 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.7 acres

Hydraulic length = 630.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.7 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.98 cfs

Discharge volume = 0.19 acre ft

Project Title = Lila Canyon DA-7 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.7 acres

Hydraulic length = 630.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.7 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 2.39 cfs

Discharge volume = 0.23 acre ft

Project Title = Lila Canyon DA-7 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.7 acres

Hydraulic length = 630.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.7 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 3.22 cfs

Discharge volume = 0.31 acre ft

Project Title = Lila Canyon DA-7 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.7 acres

Hydraulic length = 630.00 feet

Elevation change = 30.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.7 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 3.36 cfs

Discharge volume = 0.31 acre ft

Project Title = Lila Canyon DA-8a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 284.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.10 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-8a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 284.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.12 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-8a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 284.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.18 cfs

Discharge volume = 0.02 acre ft

Project Title = Lila Canyon DA-8a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.3 acres

Hydraulic length = 284.00 feet

Elevation change = 54.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.3 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.19 cfs

Discharge volume = 0.02 acre ft

Project Title = Lila Canyon DA-8b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.8 acres

Hydraulic length = 670.00 feet

Elevation change = 52.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.36 cfs

Discharge volume = 0.03 acre ft

Project Title = Lila Canyon DA-8b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.8 acres

Hydraulic length = 670.00 feet

Elevation change = 52.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.47 cfs

Discharge volume = 0.04 acre ft

Project Title = Lila Canyon DA-8b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.8 acres

Hydraulic length = 670.00 feet

Elevation change = 52.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.68 cfs

Discharge volume = 0.06 acre ft

Project Title = Lila Canyon DA-8b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.8 acres

Hydraulic length = 670.00 feet

Elevation change = 52.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.74 cfs

Discharge volume = 0.06 acre ft

Project Title = Lila Canyon DA-8c (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 1.0 acres

Hydraulic length = 410.00 feet

Elevation change = 42.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.0 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.40 cfs

Discharge volume = 0.04 acre ft

Project Title = Lila Canyon DA-8c (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 1.0 acres

Hydraulic length = 410.00 feet

Elevation change = 42.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.0 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.52 cfs

Discharge volume = 0.05 acre ft

Project Title = Lila Canyon DA-8c (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 1.0 acres

Hydraulic length = 410.00 feet

Elevation change = 42.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.0 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.76 cfs

Discharge volume = 0.08 acre ft

Project Title = Lila Canyon DA-8c (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 1.0 acres

Hydraulic length = 410.00 feet

Elevation change = 42.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.0 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.81 cfs

Discharge volume = 0.08 acre ft

Project Title = Lila Canyon DA-9 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 50.00 feet

Elevation change = 6.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.04 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-9 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 50.00 feet

Elevation change = 6.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.05 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-9 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 50.00 feet

Elevation change = 6.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.06 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-9 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 50.00 feet

Elevation change = 6.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.07 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-10 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.9 acres

Hydraulic length = 700.00 feet

Elevation change = 20.0 feet.

Concentration time = 0.08 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.9 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 2.19 cfs

Discharge volume = 0.20 acre ft

Project Title = Lila Canyon DA-10 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.9 acres

Hydraulic length = 700.00 feet

Elevation change = 20.0 feet.

Concentration time = 0.08 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.9 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 2.65 cfs

Discharge volume = 0.24 acre ft

Project Title = Lila Canyon DA-10 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.9 acres

Hydraulic length = 700.00 feet

Elevation change = 20.0 feet.

Concentration time = 0.08 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.9 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 3.57 cfs

Discharge volume = 0.33 acre ft

Project Title = Lila Canyon DA-10 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.9 acres

Hydraulic length = 700.00 feet

Elevation change = 20.0 feet.

Concentration time = 0.08 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.9 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 3.73 cfs

Discharge volume = 0.33 acre ft

Project Title = Lila Canyon DA-11 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.8 acres

Hydraulic length = 340.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.52 cfs

Discharge volume = 0.05 acre ft

Project Title = Lila Canyon DA-11 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.8 acres

Hydraulic length = 340.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.63 cfs

Discharge volume = 0.07 acre ft

Project Title = Lila Canyon DA-11 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.8 acres

Hydraulic length = 340.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.85 cfs

Discharge volume = 0.09 acre ft

Project Title = Lila Canyon DA-11 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.8 acres

Hydraulic length = 340.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.89 cfs

Discharge volume = 0.09 acre ft

Project Title = Lila Canyon DA-13a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.0 acres

Hydraulic length = 470.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.0 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.46 cfs

Discharge volume = 0.14 acre ft

Project Title = Lila Canyon DA-13a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.0 acres

Hydraulic length = 470.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.0 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.76 cfs

Discharge volume = 0.17 acre ft

Project Title = Lila Canyon DA-13a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.0 acres

Hydraulic length = 470.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.0 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 2.37 cfs

Discharge volume = 0.23 acre ft

Project Title = Lila Canyon DA-13a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 2.0 acres

Hydraulic length = 470.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 2.0 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 2.47 cfs

Discharge volume = 0.23 acre ft

Project Title = Lila Canyon DA-13b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.5 acres

Hydraulic length = 280.00 feet

Elevation change = 4.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.5 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.23 cfs

Discharge volume = 0.02 acre ft

Project Title = Lila Canyon DA-13b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.5 acres

Hydraulic length = 280.00 feet

Elevation change = 4.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.5 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.30 cfs

Discharge volume = 0.03 acre ft

Project Title = Lila Canyon DA-13b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.5 acres

Hydraulic length = 280.00 feet

Elevation change = 4.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.5 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.44 cfs

Discharge volume = 0.04 acre ft

Project Title = Lila Canyon DA-13b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.5 acres

Hydraulic length = 280.00 feet

Elevation change = 4.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.5 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.47 cfs

Discharge volume = 0.04 acre ft

Project Title = Lila Canyon DA-13c (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 460.00 feet

Elevation change = 22.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.19 cfs

Discharge volume = 0.02 acre ft

Project Title = Lila Canyon DA-13c (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 460.00 feet

Elevation change = 22.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.24 cfs

Discharge volume = 0.02 acre ft

Project Title = Lila Canyon DA-13c (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 460.00 feet

Elevation change = 22.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.35 cfs

Discharge volume = 0.03 acre ft

Project Title = Lila Canyon DA-13c (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 90.0

Area = 0.4 acres

Hydraulic length = 460.00 feet

Elevation change = 22.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.38 cfs

Discharge volume = 0.03 acre ft

Project Title = Lila Canyon DA-14a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 390.00 feet

Elevation change = 34.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.23 cfs

Discharge volume = 0.02 acre ft

Project Title = Lila Canyon DA-14a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 390.00 feet

Elevation change = 34.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.28 cfs

Discharge volume = 0.03 acre ft

Project Title = Lila Canyon DA-14a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 390.00 feet

Elevation change = 34.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.38 cfs

Discharge volume = 0.04 acre ft

Project Title = Lila Canyon DA-14a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 390.00 feet

Elevation change = 34.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.39 cfs

Discharge volume = 0.04 acre ft

Project Title = Lila Canyon DA-14b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.8 acres

Hydraulic length = 540.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.56 cfs

Discharge volume = 0.05 acre ft

Project Title = Lila Canyon DA-14b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.8 acres

Hydraulic length = 540.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.67 cfs

Discharge volume = 0.06 acre ft

Project Title = Lila Canyon DA-14b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.8 acres

Hydraulic length = 540.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.91 cfs

Discharge volume = 0.09 acre ft

Project Title = Lila Canyon DA-14b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.8 acres

Hydraulic length = 540.00 feet

Elevation change = 16.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.8 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.95 cfs

Discharge volume = 0.09 acre ft

Project Title = Lila Canyon DA-15a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 525.00 feet

Elevation change = 50.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.26 cfs

Discharge volume = 0.03 acre ft

Project Title = Lila Canyon DA-15a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 525.00 feet

Elevation change = 50.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.31 cfs

Discharge volume = 0.03 acre ft

Project Title = Lila Canyon DA-15a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 525.00 feet

Elevation change = 50.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.42 cfs

Discharge volume = 0.04 acre ft

Project Title = Lila Canyon DA-15a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 525.00 feet

Elevation change = 50.0 feet.

Concentration time = 0.04 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.44 cfs

Discharge volume = 0.04 acre ft

Project Title = Lila Canyon DA-15b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.6 acres

Hydraulic length = 270.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.6 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.40 cfs

Discharge volume = 0.04 acre ft

Project Title = Lila Canyon DA-15b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.6 acres

Hydraulic length = 270.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.6 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.48 cfs

Discharge volume = 0.05 acre ft

Project Title = Lila Canyon DA-15b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.6 acres

Hydraulic length = 270.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.6 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.64 cfs

Discharge volume = 0.07 acre ft

Project Title = Lila Canyon DA-15b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.6 acres

Hydraulic length = 270.00 feet

Elevation change = 12.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.6 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.67 cfs

Discharge volume = 0.07 acre ft

Project Title = Lila Canyon DA-16a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.2 acres

Hydraulic length = 370.00 feet

Elevation change = 10.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.11 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-16a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.2 acres

Hydraulic length = 370.00 feet

Elevation change = 10.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.14 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-16a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.2 acres

Hydraulic length = 370.00 feet

Elevation change = 10.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.19 cfs

Discharge volume = 0.02 acre ft

Project Title = Lila Canyon DA-16a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.2 acres

Hydraulic length = 370.00 feet

Elevation change = 10.0 feet.

Concentration time = 0.05 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.2 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.19 cfs

Discharge volume = 0.02 acre ft

Project Title = Lila Canyon DA-16b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 210.00 feet

Elevation change = 13.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.06 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-16b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 210.00 feet

Elevation change = 13.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.07 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-16b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 210.00 feet

Elevation change = 13.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.10 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-16b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 210.00 feet

Elevation change = 13.0 feet.

Concentration time = 0.02 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.10 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-17a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 610.00 feet

Elevation change = 19.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.31 cfs

Discharge volume = 0.03 acre ft

Project Title = Lila Canyon DA-17a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 610.00 feet

Elevation change = 19.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.38 cfs

Discharge volume = 0.04 acre ft

Project Title = Lila Canyon DA-17a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 610.00 feet

Elevation change = 19.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.51 cfs

Discharge volume = 0.05 acre ft

Project Title = Lila Canyon DA-17a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 610.00 feet

Elevation change = 19.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.53 cfs

Discharge volume = 0.05 acre ft

Project Title = Lila Canyon DA-17b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 100.00 feet

Elevation change = 5.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.05 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-17b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 100.00 feet

Elevation change = 5.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.06 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-17b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 100.00 feet

Elevation change = 5.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.08 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-17b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 100.00 feet

Elevation change = 5.0 feet.

Concentration time = 0.01 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.09 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-18a (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 175.00 feet

Elevation change = 6.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.06 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-18a (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 175.00 feet

Elevation change = 6.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.07 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-18a (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 175.00 feet

Elevation change = 6.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.10 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-18a (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.1 acres

Hydraulic length = 175.00 feet

Elevation change = 6.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.10 cfs

Discharge volume = 0.01 acre ft

Project Title = Lila Canyon DA-18b (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 650.00 feet

Elevation change = 24.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.33 cfs

Discharge volume = 0.03 acre ft

Project Title = Lila Canyon DA-18b (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 650.00 feet

Elevation change = 24.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.40 cfs

Discharge volume = 0.04 acre ft

Project Title = Lila Canyon DA-18b (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 650.00 feet

Elevation change = 24.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.53 cfs

Discharge volume = 0.05 acre ft

Project Title = Lila Canyon DA-18b (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 0.4 acres

Hydraulic length = 650.00 feet

Elevation change = 24.0 feet.

Concentration time = 0.07 hours

Unit hydrograph type = Disturbed

-- Total Area = 0.4 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 0.56 cfs

Discharge volume = 0.05 acre ft

Project Title = Lila Canyon TS-1 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 3.0 acres

Hydraulic length = 660.00 feet

Elevation change = 38.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 3.0 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.65 cfs

Discharge volume = 0.07 acre ft

Project Title = Lila Canyon TS-1 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 3.0 acres

Hydraulic length = 660.00 feet

Elevation change = 38.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 3.0 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 0.96 cfs

Discharge volume = 0.09 acre ft

Project Title = Lila Canyon TS-1 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 3.0 acres

Hydraulic length = 660.00 feet

Elevation change = 38.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 3.0 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.66 cfs

Discharge volume = 0.15 acre ft

Project Title = Lila Canyon TS-1 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 3.0 acres

Hydraulic length = 660.00 feet

Elevation change = 38.0 feet.

Concentration time = 0.06 hours

Unit hydrograph type = Disturbed

-- Total Area = 3.0 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 1.90 cfs

Discharge volume = 0.15 acre ft

Project Title = Lila Canyon Pond 1 (10/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 1.9 acres

Hydraulic length = 380.00 feet

Elevation change = 50.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.9 acres

-- Storm data

Total precipitation = 1.3 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.18 cfs

Discharge volume = 0.13 acre ft

Project Title = Lila Canyon Pond 1 (25/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 1.9 acres

Hydraulic length = 380.00 feet

Elevation change = 50.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.9 acres

-- Storm data

Total precipitation = 1.5 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.42 cfs

Discharge volume = 0.16 acre ft

Project Title = Lila Canyon Pond 1 (100/6)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 1.9 acres

Hydraulic length = 380.00 feet

Elevation change = 50.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.9 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 1.91 cfs

Discharge volume = 0.22 acre ft

Project Title = Lila Canyon Pond 1 (10/24)

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 95.0

Area = 1.9 acres

Hydraulic length = 380.00 feet

Elevation change = 50.0 feet.

Concentration time = 0.03 hours

Unit hydrograph type = Disturbed

-- Total Area = 1.9 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS Type 2 storm, 24 hour storm

Peak Discharge = 1.99 cfs

Discharge volume = 0.22 acre ft

Project Title = Lila Site - RW-1 - 100/6

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 23.5 acres

Hydraulic length = 1970.00 feet

Elevation change = 325.0 feet.

Concentration time = 0.09 hours

Unit hydrograph type = Disturbed

-- Total Area = 23.5 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 13.26 cfs

Discharge volume = 1.23 acre ft

Project Title = Lila Site - RW-2 - 100/6

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 19.1 acres

Hydraulic length = 2430.00 feet

Elevation change = 655.0 feet.

Concentration time = 0.09 hours

Unit hydrograph type = Disturbed

-- Total Area = 19.1 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 10.89 cfs

Discharge volume = 1.00 acre ft

Project Title = Lila Site - UC-1 - 100/6

WATERSHED HYDROGRAPH

Inflow into structure # 1

Structure type: Null

-- Watershed data for watershed # 1

Curve number = 83.0

Area = 281.6 acres

Hydraulic length = 5200.00 feet

Elevation change = 1480.0 feet.

Concentration time = 0.15 hours

Unit hydrograph type = Forested

-- Total Area = 281.6 acres

-- Storm data

Total precipitation = 1.9 inches

Storm type = SCS 6 hour design storm

Peak Discharge = 72.62 cfs

Discharge volume = 14.73 acre ft

Lila Canyon Mine
Ditch Calculations

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-1a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.114200	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.22	cfs

Results		
Depth	0.20	ft
Flow Area	0.08	ft²
Wetted Perimeter	0.88	ft
Top Width	0.79	ft
Critical Depth	0.24	ft
Critical Slope	0.042153	ft/ft
Velocity	2.84	ft/s
Velocity Head	0.13	ft
Specific Energy	0.32	ft
Froude Number	1.60	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-1a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.114200 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.37 cfs

Results	
Depth	0.24 ft
Flow Area	0.11 ft²
Wetted Perimeter	1.07 ft
Top Width	0.96 ft
Critical Depth	0.29 ft
Critical Slope	0.039331 ft/ft
Velocity	3.23 ft/s
Velocity Head	0.16 ft
Specific Energy	0.40 ft
Froude Number	1.65
Flow Type	Supercritical

Flow Depth Calculation
Worksheet

Project Description	
Worksheet	DD-1b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.112 000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.52	cfs

Results		
Depth	0.27	ft
Flow Area	0.15	ft²
Wetted Perimeter	1.22	ft
Top Width	1.09	ft
Critical Depth	0.33	ft
Critical Slope	0.037586	ft/ft
Velocity	3.49	ft/s
Velocity Head	0.19	ft
Specific Energy	0.46	ft
Froude Number	1.67	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-1b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.112000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.91	cfs

Results		
Depth	0.34	ft
Flow Area	0.23	ft^2
Wetted Perimeter	1.50	ft
Top Width	1.35	ft
Critical Depth	0.42	ft
Critical Slope	0.034884	ft/ft
Velocity	4.02	ft/s
Velocity Head	0.25	ft
Specific Energy	0.59	ft
Froude Number	1.73	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-1c
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.100 000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.63	cfs

Results		
Depth	0.30	ft
Flow Area	0.18	ft^2
Wetted Perimeter	1.34	ft
Top Width	1.20	ft
Critical Depth	0.36	ft
Critical Slope	0.036639	ft/ft
Velocity	3.51	ft/s
Velocity Head	0.19	ft
Specific Energy	0.49	ft
Froude Number	1.60	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-1c
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.100000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	1.10	cfs

Results		
Depth	0.37	ft
Flow Area	0.27	ft^2
Wetted Perimeter	1.65	ft
Top Width	1.48	ft
Critical Depth	0.45	ft
Critical Slope	0.034013	ft/ft
Velocity	4.04	ft/s
Velocity Head	0.25	ft
Specific Energy	0.62	ft
Froude Number	1.66	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-2a
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.120600	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	2.00	ft
Discharge	2.72	cfs

Results		
Depth	0.23	ft
Flow Area	0.56	ft²
Wetted Perimeter	3.03	ft
Top Width	2.92	ft
Critical Depth	0.34	ft
Critical Slope	0.029303	ft/ft
Velocity	4.81	ft/s
Velocity Head	0.36	ft
Specific Energy	0.59	ft
Froude Number	1.93	
Flow Type	Supercritical	

Flow Depth Calculation
Worksheet

Project Description	
Worksheet	DD-2a
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.120 ft/ft 600
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	2.00 ft
Discharge	7.14 cfs

Results	
Depth	0.39 ft
Flow Area	1.10 ft²
Wetted Perimeter	3.76 ft
Top Width	3.58 ft
Critical Depth	0.60 ft
Critical Slope	0.025602 ft/ft
Velocity	6.49 ft/s
Velocity Head	0.66 ft
Specific Energy	1.05 ft
Froude Number	2.06
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-2b
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.102900 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	2.00 ft
Discharge	2.81 cfs

Results	
Depth	0.24 ft
Flow Area	0.61 ft²
Wetted Perimeter	3.09 ft
Top Width	2.98 ft
Critical Depth	0.35 ft
Critical Slope	0.029163 ft/ft
Velocity	4.61 ft/s
Velocity Head	0.33 ft
Specific Energy	0.58 ft
Froude Number	1.80
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-2b
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.102900	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	2.00	ft
Discharge	7.29	cfs

Results		
Depth	0.42	ft
Flow Area	1.18	ft²
Wetted Perimeter	3.86	ft
Top Width	3.67	ft
Critical Depth	0.60	ft
Critical Slope	0.025530	ft/ft
Velocity	6.18	ft/s
Velocity Head	0.59	ft
Specific Energy	1.01	ft
Froude Number	1.92	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-2c
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.142900 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	2.00 ft
Discharge	2.85 cfs

Results	
Depth	0.22 ft
Flow Area	0.55 ft²
Wetted Perimeter	3.01 ft
Top Width	2.90 ft
Critical Depth	0.35 ft
Critical Slope	0.029103 ft/ft
Velocity	5.18 ft/s
Velocity Head	0.42 ft
Specific Energy	0.64 ft
Froude Number	2.09
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-2c
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.142900 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	2.00 ft
Discharge	7.37 cfs

Results	
Depth	0.38 ft
Flow Area	1.06 ft²
Wetted Perimeter	3.71 ft
Top Width	3.53 ft
Critical Depth	0.61 ft
Critical Slope	0.025493 ft/ft
Velocity	6.96 ft/s
Velocity Head	0.75 ft
Specific Energy	1.14 ft
Froude Number	2.24
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-3
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.006000 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.11 cfs

Results	
Depth	0.26 ft
Flow Area	0.14 ft²
Wetted Perimeter	1.18 ft
Top Width	1.05 ft
Critical Depth	0.18 ft
Critical Slope	0.046236 ft/ft
Velocity	0.79 ft/s
Velocity Head	0.01 ft
Specific Energy	0.27 ft
Froude Number	0.38
Flow Type	Subcritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-3
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.006 000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.21	cfs

Results		
Depth	0.34	ft
Flow Area	0.23	ft²
Wetted Perimeter	1.50	ft
Top Width	1.34	ft
Critical Depth	0.23	ft
Critical Slope	0.042415	ft/ft
Velocity	0.93	ft/s
Velocity Head	0.01	ft
Specific Energy	0.35	ft
Froude Number	0.40	
Flow Type	Subcritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-4a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.110000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.06	cfs

Results		
Depth	0.12	ft
Flow Area	0.03	ft^2
Wetted Perimeter	0.54	ft
Top Width	0.49	ft
Critical Depth	0.14	ft
Critical Slope	0.050132	ft/ft
Velocity	2.02	ft/s
Velocity Head	0.06	ft
Specific Energy	0.19	ft
Froude Number	1.45	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-4a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.110000 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.11 cfs

Results	
Depth	0.15 ft
Flow Area	0.05 ft²
Wetted Perimeter	0.68 ft
Top Width	0.61 ft
Critical Depth	0.18 ft
Critical Slope	0.046233 ft/ft
Velocity	2.35 ft/s
Velocity Head	0.09 ft
Specific Energy	0.24 ft
Froude Number	1.50
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-4b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.102 600	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.24	cfs

Results		
Depth	0.21	ft
Flow Area	0.09	ft²
Wetted Perimeter	0.93	ft
Top Width	0.83	ft
Critical Depth	0.25	ft
Critical Slope	0.041670	ft/ft
Velocity	2.79	ft/s
Velocity Head	0.12	ft
Specific Energy	0.33	ft
Froude Number	1.53	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-4b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.102600	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.44	cfs

Results		
Depth	0.26	ft
Flow Area	0.14	ft²
Wetted Perimeter	1.16	ft
Top Width	1.04	ft
Critical Depth	0.31	ft
Critical Slope	0.038435	ft/ft
Velocity	3.24	ft/s
Velocity Head	0.16	ft
Specific Energy	0.42	ft
Froude Number	1.58	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-4c
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.100 000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.66	cfs

Results		
Depth	0.30	ft
Flow Area	0.19	ft^2
Wetted Perimeter	1.36	ft
Top Width	1.22	ft
Critical Depth	0.37	ft
Critical Slope	0.036412	ft/ft
Velocity	3.55	ft/s
Velocity Head	0.20	ft
Specific Energy	0.50	ft
Froude Number	1.61	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-4c
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.100 000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	1.15	cfs

Results		
Depth	0.38	ft
Flow Area	0.28	ft^2
Wetted Perimeter	1.68	ft
Top Width	1.50	ft
Critical Depth	0.46	ft
Critical Slope	0.033812	ft/ft
Velocity	4.08	ft/s
Velocity Head	0.26	ft
Specific Energy	0.63	ft
Froude Number	1.66	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-5a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.131 ft/ft 100
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.05 cfs

Results	
Depth	0.11 ft
Flow Area	0.02 ft²
Wetted Perimeter	0.49 ft
Top Width	0.44 ft
Critical Depth	0.13 ft
Critical Slope	0.051359 ft/ft
Velocity	2.06 ft/s
Velocity Head	0.07 ft
Specific Energy	0.18 ft
Froude Number	1.55
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-5a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.131 100	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.09	cfs

Results		
Depth	0.14	ft
Flow Area	0.04	ft²
Wetted Perimeter	0.61	ft
Top Width	0.55	ft
Critical Depth	0.17	ft
Critical Slope	0.047489	ft/ft
Velocity	2.39	ft/s
Velocity Head	0.09	ft
Specific Energy	0.23	ft
Froude Number	1.61	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-5b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.111 100	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.16	cfs

Results		
Depth	0.18	ft
Flow Area	0.06	ft²
Wetted Perimeter	0.79	ft
Top Width	0.70	ft
Critical Depth	0.21	ft
Critical Slope	0.043980	ft/ft
Velocity	2.59	ft/s
Velocity Head	0.10	ft
Specific Energy	0.28	ft
Froude Number	1.54	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-5b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.111 100	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.30	cfs

Results		
Depth	0.22	ft
Flow Area	0.10	ft²
Wetted Perimeter	0.99	ft
Top Width	0.89	ft
Critical Depth	0.27	ft
Critical Slope	0.040446	ft/ft
Velocity	3.04	ft/s
Velocity Head	0.14	ft
Specific Energy	0.37	ft
Froude Number	1.61	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-5c
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.095 ft/ft 200
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.45 cfs

Results	
Depth	0.27 ft
Flow Area	0.14 ft²
Wetted Perimeter	1.19 ft
Top Width	1.07 ft
Critical Depth	0.32 ft
Critical Slope	0.038319 ft/ft
Velocity	3.17 ft/s
Velocity Head	0.16 ft
Specific Energy	0.42 ft
Froude Number	1.53
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-5c
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.095 ft/ft 200
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.79 cfs

Results	
Depth	0.33 ft
Flow Area	0.22 ft²
Wetted Perimeter	1.47 ft
Top Width	1.32 ft
Critical Depth	0.40 ft
Critical Slope	0.035549 ft/ft
Velocity	3.65 ft/s
Velocity Head	0.21 ft
Specific Energy	0.54 ft
Froude Number	1.59
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-6a
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Slope	0.180 000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	3.00	ft
Discharge	2.94	cfs

Results		
Depth	0.19	ft
Flow Area	0.62	ft^2
Wetted Perimeter	3.83	ft
Top Width	3.74	ft
Critical Depth	0.29	ft
Critical Slope	0.038670	ft/ft
Velocity	4.71	ft/s
Velocity Head	0.34	ft
Specific Energy	0.53	ft
Froude Number	2.03	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-6a
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.040
Slope	0.180 000 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	3.00 ft
Discharge	7.55 cfs

Results	
Depth	0.32 ft
Flow Area	1.17 ft²
Wetted Perimeter	4.43 ft
Top Width	4.28 ft
Critical Depth	0.52 ft
Critical Slope	0.033399 ft/ft
Velocity	6.47 ft/s
Velocity Head	0.65 ft
Specific Energy	0.97 ft
Froude Number	2.19
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-6b
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.025600 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	1.00 ft
Discharge	4.54 cfs

Results	
Depth	0.60 ft
Flow Area	1.32 ft²
Wetted Perimeter	3.69 ft
Top Width	3.40 ft
Critical Depth	0.59 ft
Critical Slope	0.027318 ft/ft
Velocity	3.43 ft/s
Velocity Head	0.18 ft
Specific Energy	0.78 ft
Froude Number	0.97
Flow Type	Subcritical

Flow Depth Calculation Worksheet

Project Description

Worksheet	DD-6b
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Mannings Coefficient	0.035	
Slope	0.025600	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	1.00	ft
Discharge	10.82	cfs

Results

Depth	0.90	ft
Flow Area	2.52	ft²
Wetted Perimeter	5.03	ft
Top Width	4.60	ft
Critical Depth	0.91	ft
Critical Slope	0.024474	ft/ft
Velocity	4.29	ft/s
Velocity Head	0.29	ft
Specific Energy	1.19	ft
Froude Number	1.02	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-6c
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.033800	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	1.00	ft
Discharge	1.18	cfs

Results		
Depth	0.28	ft
Flow Area	0.45	ft^2
Wetted Perimeter	2.27	ft
Top Width	2.14	ft
Critical Depth	0.29	ft
Critical Slope	0.032550	ft/ft
Velocity	2.64	ft/s
Velocity Head	0.11	ft
Specific Energy	0.39	ft
Froude Number	1.02	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-6c
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.033800 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	1.00 ft
Discharge	2.40 cfs

Results	
Depth	0.41 ft
Flow Area	0.75 ft²
Wetted Perimeter	2.84 ft
Top Width	2.64 ft
Critical Depth	0.42 ft
Critical Slope	0.029643 ft/ft
Velocity	3.21 ft/s
Velocity Head	0.16 ft
Specific Energy	0.57 ft
Froude Number	1.06
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-7
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.010800	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	1.00	ft
Discharge	2.45	cfs

Results		
Depth	0.55	ft
Flow Area	1.15	ft^2
Wetted Perimeter	3.46	ft
Top Width	3.20	ft
Critical Depth	0.43	ft
Critical Slope	0.029564	ft/ft
Velocity	2.12	ft/s
Velocity Head	0.07	ft
Specific Energy	0.62	ft
Froude Number	0.62	
Flow Type	Subcritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-7
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.010800	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	1.00	ft
Discharge	4.31	cfs

Results		
Depth	0.72	ft
Flow Area	1.75	ft²
Wetted Perimeter	4.22	ft
Top Width	3.88	ft
Critical Depth	0.58	ft
Critical Slope	0.027500	ft/ft
Velocity	2.46	ft/s
Velocity Head	0.09	ft
Specific Energy	0.81	ft
Froude Number	0.64	
Flow Type	Subcritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-8a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.204 200	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.10	cfs

Results		
Depth	0.13	ft
Flow Area	0.03	ft²
Wetted Perimeter	0.59	ft
Top Width	0.53	ft
Critical Depth	0.17	ft
Critical Slope	0.046828	ft/ft
Velocity	2.90	ft/s
Velocity Head	0.13	ft
Specific Energy	0.26	ft
Froude Number	1.99	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-8a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.204200 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.19 cfs

Results	
Depth	0.17 ft
Flow Area	0.06 ft^2
Wetted Perimeter	0.75 ft
Top Width	0.67 ft
Critical Depth	0.22 ft
Critical Slope	0.042986 ft/ft
Velocity	3.40 ft/s
Velocity Head	0.18 ft
Specific Energy	0.35 ft
Froude Number	2.08
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-8b
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.078 100	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	1.00	ft
Discharge	2.91	cfs

Results		
Depth	0.37	ft
Flow Area	0.63	ft²
Wetted Perimeter	2.64	ft
Top Width	2.46	ft
Critical Depth	0.47	ft
Critical Slope	0.028916	ft/ft
Velocity	4.59	ft/s
Velocity Head	0.33	ft
Specific Energy	0.69	ft
Froude Number	1.59	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-8b
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.078 ft/ft 100
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	1.00 ft
Discharge	5.24 cfs

Results	
Depth	0.49 ft
Flow Area	0.98 ft²
Wetted Perimeter	3.20 ft
Top Width	2.97 ft
Critical Depth	0.64 ft
Critical Slope	0.026826 ft/ft
Velocity	5.37 ft/s
Velocity Head	0.45 ft
Specific Energy	0.94 ft
Froude Number	1.65
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-8c
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.040
Slope	0.103400 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	2.00 ft
Discharge	6.12 cfs

Results	
Depth	0.41 ft
Flow Area	1.14 ft^2
Wetted Perimeter	3.82 ft
Top Width	3.63 ft
Critical Depth	0.55 ft
Critical Slope	0.034142 ft/ft
Velocity	5.35 ft/s
Velocity Head	0.44 ft
Specific Energy	0.85 ft
Froude Number	1.68
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-8c
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.040	
Slope	0.103400	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	2.00	ft
Discharge	14.03	cfs

Results		
Depth	0.63	ft
Flow Area	2.07	ft²
Wetted Perimeter	4.83	ft
Top Width	4.53	ft
Critical Depth	0.86	ft
Critical Slope	0.030599	ft/ft
Velocity	6.78	ft/s
Velocity Head	0.72	ft
Specific Energy	1.35	ft
Froude Number	1.77	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-9
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.100 ft/ft 000
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.04 cfs

Results	
Depth	0.11 ft
Flow Area	0.02 ft²
Wetted Perimeter	0.48 ft
Top Width	0.43 ft
Critical Depth	0.12 ft
Critical Slope	0.052913 ft/ft
Velocity	1.76 ft/s
Velocity Head	0.05 ft
Specific Energy	0.15 ft
Froude Number	1.35
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-9
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.100 000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.07	cfs

Results		
Depth	0.13	ft
Flow Area	0.03	ft²
Wetted Perimeter	0.59	ft
Top Width	0.53	ft
Critical Depth	0.15	ft
Critical Slope	0.049110	ft/ft
Velocity	2.03	ft/s
Velocity Head	0.06	ft
Specific Energy	0.20	ft
Froude Number	1.40	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-10
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.030200 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	1.00 ft
Discharge	2.19 cfs

Results	
Depth	0.40 ft
Flow Area	0.73 ft²
Wetted Perimeter	2.80 ft
Top Width	2.61 ft
Critical Depth	0.40 ft
Critical Slope	0.029996 ft/ft
Velocity	3.00 ft/s
Velocity Head	0.14 ft
Specific Energy	0.54 ft
Froude Number	1.00
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-10
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.030 200	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	1.00	ft
Discharge	3.73	cfs

Results		
Depth	0.53	ft
Flow Area	1.08	ft^2
Wetted Perimeter	3.35	ft
Top Width	3.10	ft
Critical Depth	0.53	ft
Critical Slope	0.028011	ft/ft
Velocity	3.46	ft/s
Velocity Head	0.19	ft
Specific Energy	0.71	ft
Froude Number	1.04	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-11
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.050 600	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.52	cfs

Results		
Depth	0.32	ft
Flow Area	0.20	ft²
Wetted Perimeter	1.42	ft
Top Width	1.27	ft
Critical Depth	0.33	ft
Critical Slope	0.037587	ft/ft
Velocity	2.59	ft/s
Velocity Head	0.10	ft
Specific Energy	0.42	ft
Froude Number	1.15	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-11
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.050 ft/ft 600
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.89 cfs

Results	
Depth	0.39 ft
Flow Area	0.30 ft²
Wetted Perimeter	1.73 ft
Top Width	1.55 ft
Critical Depth	0.42 ft
Critical Slope	0.034988 ft/ft
Velocity	2.97 ft/s
Velocity Head	0.14 ft
Specific Energy	0.52 ft
Froude Number	1.19
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-13a
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.025 300	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	1.00	ft
Discharge	3.06	cfs

Results		
Depth	0.50	ft
Flow Area	0.99	ft²
Wetted Perimeter	3.23	ft
Top Width	2.99	ft
Critical Depth	0.48	ft
Critical Slope	0.028730	ft/ft
Velocity	3.08	ft/s
Velocity Head	0.15	ft
Specific Energy	0.65	ft
Froude Number	0.94	
Flow Type	Subcritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-13a
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.025 ft/ft 300
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	1.00 ft
Discharge	5.27 cfs

Results	
Depth	0.65 ft
Flow Area	1.48 ft²
Wetted Perimeter	3.89 ft
Top Width	3.59 ft
Critical Depth	0.64 ft
Critical Slope	0.026806 ft/ft
Velocity	3.55 ft/s
Velocity Head	0.20 ft
Specific Energy	0.84 ft
Froude Number	0.97
Flow Type	Subcritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-13b
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.032300	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	1.00	ft
Discharge	3.58	cfs

Results		
Depth	0.51	ft
Flow Area	1.02	ft²
Wetted Perimeter	3.26	ft
Top Width	3.03	ft
Critical Depth	0.52	ft
Critical Slope	0.028158	ft/ft
Velocity	3.51	ft/s
Velocity Head	0.19	ft
Specific Energy	0.70	ft
Froude Number	1.07	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-13b
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.032300	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	1.00	ft
Discharge	6.16	cfs

Results		
Depth	0.66	ft
Flow Area	1.52	ft^2
Wetted Perimeter	3.94	ft
Top Width	3.63	ft
Critical Depth	0.69	ft
Critical Slope	0.026281	ft/ft
Velocity	4.05	ft/s
Velocity Head	0.25	ft
Specific Energy	0.91	ft
Froude Number	1.10	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-13c
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.033 000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	1.00	ft
Discharge	5.77	cfs

Results		
Depth	0.63	ft
Flow Area	1.44	ft²
Wetted Perimeter	3.84	ft
Top Width	3.54	ft
Critical Depth	0.67	ft
Critical Slope	0.026500	ft/ft
Velocity	4.01	ft/s
Velocity Head	0.25	ft
Specific Energy	0.88	ft
Froude Number	1.11	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-13c
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.033 000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	1.00	ft
Discharge	9.89	cfs

Results		
Depth	0.82	ft
Flow Area	2.15	ft²
Wetted Perimeter	4.65	ft
Top Width	4.26	ft
Critical Depth	0.87	ft
Critical Slope	0.024753	ft/ft
Velocity	4.61	ft/s
Velocity Head	0.33	ft
Specific Energy	1.15	ft
Froude Number	1.14	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-13d
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.012 500	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	3.00	ft
Discharge	6.35	cfs

Results		
Depth	0.57	ft
Flow Area	2.36	ft²
Wetted Perimeter	5.55	ft
Top Width	5.28	ft
Critical Depth	0.46	ft
Critical Slope	0.026236	ft/ft
Velocity	2.69	ft/s
Velocity Head	0.11	ft
Specific Energy	0.68	ft
Froude Number	0.71	
Flow Type	Subcritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-13d
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.012 500	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	3.00	ft
Discharge	14.50	cfs

Results		
Depth	0.89	ft
Flow Area	4.25	ft²
Wetted Perimeter	6.98	ft
Top Width	6.56	ft
Critical Depth	0.75	ft
Critical Slope	0.023311	ft/ft
Velocity	3.41	ft/s
Velocity Head	0.18	ft
Specific Energy	1.07	ft
Froude Number	0.75	
Flow Type	Subcritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-13e
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.047800	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	3.00	ft
Discharge	6.54	cfs

Results		
Depth	0.40	ft
Flow Area	1.52	ft^2
Wetted Perimeter	4.79	ft
Top Width	4.60	ft
Critical Depth	0.47	ft
Critical Slope	0.026120	ft/ft
Velocity	4.31	ft/s
Velocity Head	0.29	ft
Specific Energy	0.69	ft
Froude Number	1.32	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-13e
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.047800 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Bottom Width	3.00 ft
Discharge	14.88 cfs

Results	
Depth	0.63 ft
Flow Area	2.68 ft²
Wetted Perimeter	5.82 ft
Top Width	5.52 ft
Critical Depth	0.77 ft
Critical Slope	0.023228 ft/ft
Velocity	5.54 ft/s
Velocity Head	0.48 ft
Specific Energy	1.11 ft
Froude Number	1.40
Flow Type	Supercritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-14a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.087200	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.23	cfs

Results		
Depth	0.21	ft
Flow Area	0.09	ft^2
Wetted Perimeter	0.94	ft
Top Width	0.84	ft
Critical Depth	0.24	ft
Critical Slope	0.041908	ft/ft
Velocity	2.59	ft/s
Velocity Head	0.10	ft
Specific Energy	0.32	ft
Froude Number	1.41	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-14a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.087 200	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.39	cfs

Results		
Depth	0.26	ft
Flow Area	0.13	ft^2
Wetted Perimeter	1.15	ft
Top Width	1.03	ft
Critical Depth	0.30	ft
Critical Slope	0.039057	ft/ft
Velocity	2.96	ft/s
Velocity Head	0.14	ft
Specific Energy	0.39	ft
Froude Number	1.46	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-14b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.031500	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.56	cfs

Results		
Depth	0.36	ft
Flow Area	0.25	ft²
Wetted Perimeter	1.59	ft
Top Width	1.42	ft
Critical Depth	0.34	ft
Critical Slope	0.037217	ft/ft
Velocity	2.21	ft/s
Velocity Head	0.08	ft
Specific Energy	0.43	ft
Froude Number	0.92	
Flow Type	Subcritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-14b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.031500 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.95 cfs

Results	
Depth	0.43 ft
Flow Area	0.38 ft²
Wetted Perimeter	1.94 ft
Top Width	1.73 ft
Critical Depth	0.43 ft
Critical Slope	0.034685 ft/ft
Velocity	2.52 ft/s
Velocity Head	0.10 ft
Specific Energy	0.53 ft
Froude Number	0.96
Flow Type	Subcritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-15a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.097 000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.26	cfs

Results		
Depth	0.22	ft
Flow Area	0.09	ft^2
Wetted Perimeter	0.97	ft
Top Width	0.86	ft
Critical Depth	0.25	ft
Critical Slope	0.041227	ft/ft
Velocity	2.78	ft/s
Velocity Head	0.12	ft
Specific Energy	0.34	ft
Froude Number	1.49	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-15a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.097000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.44	cfs

Results		
Depth	0.26	ft
Flow Area	0.14	ft^2
Wetted Perimeter	1.18	ft
Top Width	1.05	ft
Critical Depth	0.31	ft
Critical Slope	0.038434	ft/ft
Velocity	3.18	ft/s
Velocity Head	0.16	ft
Specific Energy	0.42	ft
Froude Number	1.54	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-15b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.040700	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.66	cfs

Results		
Depth	0.36	ft
Flow Area	0.26	ft^2
Wetted Perimeter	1.61	ft
Top Width	1.44	ft
Critical Depth	0.37	ft
Critical Slope	0.036411	ft/ft
Velocity	2.54	ft/s
Velocity Head	0.10	ft
Specific Energy	0.46	ft
Froude Number	1.05	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-15b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.040700	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	1.11	cfs

Results		
Depth	0.44	ft
Flow Area	0.38	ft²
Wetted Perimeter	1.96	ft
Top Width	1.75	ft
Critical Depth	0.45	ft
Critical Slope	0.033973	ft/ft
Velocity	2.89	ft/s
Velocity Head	0.13	ft
Specific Energy	0.57	ft
Froude Number	1.09	
Flow Type	Supercritical	

Flow Depth Calculation
Worksheet

Project Description	
Worksheet	DD-16a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.029700	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.11	cfs

Results		
Depth	0.20	ft
Flow Area	0.08	ft²
Wetted Perimeter	0.87	ft
Top Width	0.78	ft
Critical Depth	0.18	ft
Critical Slope	0.046236	ft/ft
Velocity	1.44	ft/s
Velocity Head	0.03	ft
Specific Energy	0.23	ft
Froude Number	0.81	
Flow Type	Subcritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-16a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.029700	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.19	cfs

Results		
Depth	0.24	ft
Flow Area	0.12	ft^2
Wetted Perimeter	1.07	ft
Top Width	0.96	ft
Critical Depth	0.22	ft
Critical Slope	0.042985	ft/ft
Velocity	1.65	ft/s
Velocity Head	0.04	ft
Specific Energy	0.28	ft
Froude Number	0.84	
Flow Type	Subcritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-16b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.060 600	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.17	cfs

Results		
Depth	0.20	ft
Flow Area	0.08	ft^2
Wetted Perimeter	0.90	ft
Top Width	0.80	ft
Critical Depth	0.21	ft
Critical Slope	0.043629	ft/ft
Velocity	2.10	ft/s
Velocity Head	0.07	ft
Specific Energy	0.27	ft
Froude Number	1.17	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-16b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.060600	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.29	cfs

Results		
Depth	0.25	ft
Flow Area	0.12	ft²
Wetted Perimeter	1.10	ft
Top Width	0.98	ft
Critical Depth	0.27	ft
Critical Slope	0.040630	ft/ft
Velocity	2.40	ft/s
Velocity Head	0.09	ft
Specific Energy	0.34	ft
Froude Number	1.21	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-17a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.026800 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.31 cfs

Results	
Depth	0.29 ft
Flow Area	0.17 ft²
Wetted Perimeter	1.31 ft
Top Width	1.18 ft
Critical Depth	0.27 ft
Critical Slope	0.040270 ft/ft
Velocity	1.80 ft/s
Velocity Head	0.05 ft
Specific Energy	0.34 ft
Froude Number	0.83
Flow Type	Subcritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-17a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.026800 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.53 cfs

Results	
Depth	0.36 ft
Flow Area	0.26 ft²
Wetted Perimeter	1.61 ft
Top Width	1.44 ft
Critical Depth	0.34 ft
Critical Slope	0.037490 ft/ft
Velocity	2.05 ft/s
Velocity Head	0.07 ft
Specific Energy	0.42 ft
Froude Number	0.85
Flow Type	Subcritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-17b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.041200	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	1.15	cfs

Results		
Depth	0.44	ft
Flow Area	0.39	ft^2
Wetted Perimeter	1.98	ft
Top Width	1.77	ft
Critical Depth	0.46	ft
Critical Slope	0.033813	ft/ft
Velocity	2.93	ft/s
Velocity Head	0.13	ft
Specific Energy	0.58	ft
Froude Number	1.10	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-17b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.041 200	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	1.96	cfs

Results		
Depth	0.54	ft
Flow Area	0.59	ft²
Wetted Perimeter	2.42	ft
Top Width	2.16	ft
Critical Depth	0.57	ft
Critical Slope	0.031492	ft/ft
Velocity	3.35	ft/s
Velocity Head	0.17	ft
Specific Energy	0.72	ft
Froude Number	1.13	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-18a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.028600 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.06 cfs

Results	
Depth	0.16 ft
Flow Area	0.05 ft^2
Wetted Perimeter	0.70 ft
Top Width	0.63 ft
Critical Depth	0.14 ft
Critical Slope	0.050132 ft/ft
Velocity	1.22 ft/s
Velocity Head	0.02 ft
Specific Energy	0.18 ft
Froude Number	0.77
Flow Type	Subcritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-18a
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.028 600	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.10	cfs

Results		
Depth	0.19	ft
Flow Area	0.07	ft²
Wetted Perimeter	0.85	ft
Top Width	0.76	ft
Critical Depth	0.17	ft
Critical Slope	0.046828	ft/ft
Velocity	1.39	ft/s
Velocity Head	0.03	ft
Specific Energy	0.22	ft
Froude Number	0.79	
Flow Type	Subcritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-18b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coefficient	0.035
Slope	0.035 400 ft/ft
Left Side Slope	2.00 H : V
Right Side Slope	2.00 H : V
Discharge	0.39 cfs

Results	
Depth	0.30 ft
Flow Area	0.18 ft²
Wetted Perimeter	1.36 ft
Top Width	1.22 ft
Critical Depth	0.30 ft
Critical Slope	0.039056 ft/ft
Velocity	2.11 ft/s
Velocity Head	0.07 ft
Specific Energy	0.37 ft
Froude Number	0.95
Flow Type	Subcritical

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-18b
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.035 400	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	0.66	cfs

Results		
Depth	0.37	ft
Flow Area	0.27	ft^2
Wetted Perimeter	1.66	ft
Top Width	1.48	ft
Critical Depth	0.37	ft
Critical Slope	0.036411	ft/ft
Velocity	2.41	ft/s
Velocity Head	0.09	ft
Specific Energy	0.46	ft
Froude Number	0.99	
Flow Type	Subcritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-20
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.04880	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	13.22	cfs

Results		
Depth	1.07	ft
Flow Area	2.30	ft²
Wetted Perimeter	4.80	ft
Top Width	4.29	ft
Critical Depth	1.22	ft
Critical Slope	0.024416	ft/ft
Velocity	5.75	ft/s
Velocity Head	0.51	ft
Specific Energy	1.59	ft
Froude Number	1.38	
Flow Type	Supercritical	

Flow Depth Calculation Worksheet

Project Description	
Worksheet	DD-20
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.048800	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Discharge	5.72	cfs

Results		
Depth	0.78	ft
Flow Area	1.23	ft²
Wetted Perimeter	3.50	ft
Top Width	3.13	ft
Critical Depth	0.87	ft
Critical Slope	0.027301	ft/ft
Velocity	4.66	ft/s
Velocity Head	0.34	ft
Specific Energy	1.12	ft
Froude Number	1.31	
Flow Type	Supercritical	

Channel Depth
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	RD-1
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.050000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	3.00	ft
Discharge	13.26	cfs

Results		
Depth	0.58	ft
Flow Area	2.44	ft²
Wetted Perimeter	5.61	ft
Top Width	5.34	ft
Critical Depth	0.72	ft
Critical Slope	0.023600	ft/ft
Velocity	5.44	ft/s
Velocity Head	0.46	ft
Specific Energy	1.04	ft
Froude Number	1.42	
Flow Type	Supercritical	

Hydrologic Design Inc

Channel Depth
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	RD-2
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.035	
Slope	0.100000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	3.00	ft
Discharge	10.89	cfs

Results		
Depth	0.43	ft
Flow Area	1.67	ft^2
Wetted Perimeter	4.93	ft
Top Width	4.73	ft
Critical Depth	0.64	ft
Critical Slope	0.024259	ft/ft
Velocity	6.52	ft/s
Velocity Head	0.66	ft
Specific Energy	1.09	ft
Froude Number	1.93	
Flow Type	Supercritical	

Lila Canyon Mine
Culvert Calculations

Flow Velocity Calculation Worksheet

Project Description

Worksheet	DC-1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Mannings Coefficient	0.024	
Slope	0.133300	ft/ft
Diameter	18	in
Discharge	7.29	cfs

Results

Depth	0.61	ft
Flow Area	0.68	ft^2
Wetted Perimeter	2.08	ft
Top Width	1.47	ft
Critical Depth	1.05	ft
Percent Full	40.9	%
Critical Slope	0.023666	ft/ft
Velocity	10.72	ft/s
Velocity Head	1.79	ft
Specific Energy	2.40	ft
Froude Number	2.78	
Maximum Discharge	22.35	cfs
Discharge Full	20.77	cfs
Slope Full	0.016417	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-2
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.107	ft/ft
Diameter	18	in
Discharge	0.91	cfs

Results		
Depth	0.23	ft
Flow Area	0.17	ft²
Wetted Perimeter	1.21	ft
Top Width	1.08	ft
Critical Depth	0.36	ft
Percent Full	15.3	%
Critical Slope	0.018323	ft/ft
Velocity	5.31	ft/s
Velocity Head	0.44	ft
Specific Energy	0.67	ft
Froude Number	2.35	
Maximum Discharge	19.28	cfs
Discharge Full	17.92	cfs
Slope Full	0.000278	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-3
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.030300	ft/ft
Diameter	18	in
Discharge	7.37	cfs

Results		
Depth	0.99	ft
Flow Area	1.24	ft²
Wetted Perimeter	2.85	ft
Top Width	1.42	ft
Critical Depth	1.05	ft
Percent Full	66.1	%
Critical Slope	0.025868	ft/ft
Velocity	5.94	ft/s
Velocity Head	0.55	ft
Specific Energy	1.54	ft
Froude Number	1.12	
Maximum Discharge	10.23	cfs
Discharge Full	9.51	cfs
Slope Full	0.018207	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-4
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.215000	ft/ft
Diameter	18	in
Discharge	0.21	cfs

Results		
Depth	0.10	ft
Flow Area	0.05	ft²
Wetted Perimeter	0.77	ft
Top Width	0.74	ft
Critical Depth	0.17	ft
Percent Full	6.5	%
Critical Slope	0.020771	ft/ft
Velocity	4.35	ft/s
Velocity Head	0.29	ft
Specific Energy	0.39	ft
Froude Number	3.00	
Maximum Discharge	27.24	cfs
Discharge Full	25.33	cfs
Slope Full	0.000015	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-5
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.120000	ft/ft
Diameter	18	in
Discharge	0.30	cfs

Results		
Depth	0.13	ft
Flow Area	0.08	ft^2
Wetted Perimeter	0.90	ft
Top Width	0.85	ft
Critical Depth	0.20	ft
Percent Full	8.8	%
Critical Slope	0.019986	ft/ft
Velocity	3.95	ft/s
Velocity Head	0.24	ft
Specific Energy	0.37	ft
Froude Number	2.33	
Maximum Discharge	20.35	cfs
Discharge Full	18.92	cfs
Slope Full	0.000030	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation
Worksheet

Project Description	
Worksheet	DC-6
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.050000	ft/ft
Diameter	18	in
Discharge	7.55	cfs

Results		
Depth	0.85	ft
Flow Area	1.04	ft^2
Wetted Perimeter	2.56	ft
Top Width	1.49	ft
Critical Depth	1.06	ft
Percent Full	56.9	%
Critical Slope	0.026305	ft/ft
Velocity	7.27	ft/s
Velocity Head	0.82	ft
Specific Energy	1.68	ft
Froude Number	1.53	
Maximum Discharge	13.14	cfs
Discharge Full	12.21	cfs
Slope Full	0.019107	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation
Worksheet

Project Description	
Worksheet	DC-7
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.464000	ft/ft
Diameter	18	in
Discharge	4.31	cfs

Results		
Depth	0.34	ft
Flow Area	0.31	ft²
Wetted Perimeter	1.50	ft
Top Width	1.26	ft
Critical Depth	0.80	ft
Percent Full	23.0	%
Critical Slope	0.020400	ft/ft
Velocity	14.05	ft/s
Velocity Head	3.07	ft
Specific Energy	3.41	ft
Froude Number	5.03	
Maximum Discharge	40.02	cfs
Discharge Full	37.21	cfs
Slope Full	0.006227	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-8
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.388000	ft/ft
Diameter	24	in
Discharge	13.22	cfs

Results		
Depth	0.58	ft
Flow Area	0.75	ft^2
Wetted Perimeter	2.26	ft
Top Width	1.81	ft
Critical Depth	1.31	ft
Percent Full	28.8	%
Critical Slope	0.021657	ft/ft
Velocity	17.69	ft/s
Velocity Head	4.86	ft
Specific Energy	5.44	ft
Froude Number	4.85	
Maximum Discharge	78.82	cfs
Discharge Full	73.27	cfs
Slope Full	0.012631	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-9
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.057000	ft/ft
Diameter	18	in
Discharge	1.15	cfs

Results		
Depth	0.30	ft
Flow Area	0.25	ft²
Wetted Perimeter	1.39	ft
Top Width	1.20	ft
Critical Depth	0.40	ft
Percent Full	20.1	%
Critical Slope	0.018135	ft/ft
Velocity	4.55	ft/s
Velocity Head	0.32	ft
Specific Energy	0.62	ft
Froude Number	1.75	
Maximum Discharge	14.03	cfs
Discharge Full	13.04	cfs
Slope Full	0.000443	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-10
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.142500	ft/ft
Diameter	18	in
Discharge	1.94	cfs

Results		
Depth	0.31	ft
Flow Area	0.26	ft^2
Wetted Perimeter	1.42	ft
Top Width	1.22	ft
Critical Depth	0.52	ft
Percent Full	20.7	%
Critical Slope	0.018269	ft/ft
Velocity	7.33	ft/s
Velocity Head	0.83	ft
Specific Energy	1.15	ft
Froude Number	2.77	
Maximum Discharge	22.18	cfs
Discharge Full	20.62	cfs
Slope Full	0.001262	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-11
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.046000	ft/ft
Diameter	18	in
Discharge	2.80	cfs

Results		
Depth	0.50	ft
Flow Area	0.51	ft²
Wetted Perimeter	1.84	ft
Top Width	1.41	ft
Critical Depth	0.64	ft
Percent Full	33.3	%
Critical Slope	0.018804	ft/ft
Velocity	5.44	ft/s
Velocity Head	0.46	ft
Specific Energy	0.96	ft
Froude Number	1.59	
Maximum Discharge	12.60	cfs
Discharge Full	11.71	cfs
Slope Full	0.002628	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-12
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.040000	ft/ft
Diameter	18	in
Discharge	3.73	cfs

Results		
Depth	0.60	ft
Flow Area	0.67	ft^2
Wetted Perimeter	2.06	ft
Top Width	1.47	ft
Critical Depth	0.74	ft
Percent Full	40.3	%
Critical Slope	0.019705	ft/ft
Velocity	5.60	ft/s
Velocity Head	0.49	ft
Specific Energy	1.09	ft
Froude Number	1.47	
Maximum Discharge	11.75	cfs
Discharge Full	10.92	cfs
Slope Full	0.004664	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-12
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.033300	ft/ft
Diameter	24	in
Discharge	14.50	cfs

Results		
Depth	1.20	ft
Flow Area	1.98	ft²
Wetted Perimeter	3.55	ft
Top Width	1.96	ft
Critical Depth	1.37	ft
Percent Full	60.2	%
Critical Slope	0.022857	ft/ft
Velocity	7.34	ft/s
Velocity Head	0.84	ft
Specific Energy	2.04	ft
Froude Number	1.29	
Maximum Discharge	23.09	cfs
Discharge Full	21.47	cfs
Slope Full	0.015195	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-14
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.033300	ft/ft
Diameter	18	in
Discharge	1.34	cfs

Results		
Depth	0.37	ft
Flow Area	0.34	ft²
Wetted Perimeter	1.56	ft
Top Width	1.29	ft
Critical Depth	0.43	ft
Percent Full	24.8	%
Critical Slope	0.018114	ft/ft
Velocity	3.93	ft/s
Velocity Head	0.24	ft
Specific Energy	0.61	ft
Froude Number	1.35	
Maximum Discharge	10.72	cfs
Discharge Full	9.97	cfs
Slope Full	0.000602	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-15
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.033300	ft/ft
Diameter	18	in
Discharge	0.19	cfs

Results		
Depth	0.14	ft
Flow Area	0.09	ft²
Wetted Perimeter	0.94	ft
Top Width	0.88	ft
Critical Depth	0.16	ft
Percent Full	9.6	%
Critical Slope	0.020905	ft/ft
Velocity	2.20	ft/s
Velocity Head	0.08	ft
Specific Energy	0.22	ft
Froude Number	1.24	
Maximum Discharge	10.72	cfs
Discharge Full	9.97	cfs
Slope Full	0.000012	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation
Worksheet

Project Description	
Worksheet	DC-16
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.033300	ft/ft
Diameter	18	in
Discharge	0.53	cfs

Results		
Depth	0.24	ft
Flow Area	0.18	ft²
Wetted Perimeter	1.22	ft
Top Width	1.09	ft
Critical Depth	0.27	ft
Percent Full	15.7	%
Critical Slope	0.018890	ft/ft
Velocity	2.99	ft/s
Velocity Head	0.14	ft
Specific Energy	0.37	ft
Froude Number	1.31	
Maximum Discharge	10.72	cfs
Discharge Full	9.97	cfs
Slope Full	0.000094	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-17
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.040000	ft/ft
Diameter	18	in
Discharge	2.25	cfs

Results		
Depth	0.46	ft
Flow Area	0.46	ft^2
Wetted Perimeter	1.76	ft
Top Width	1.38	ft
Critical Depth	0.57	ft
Percent Full	30.8	%
Critical Slope	0.018367	ft/ft
Velocity	4.87	ft/s
Velocity Head	0.37	ft
Specific Energy	0.83	ft
Froude Number	1.49	
Maximum Discharge	11.75	cfs
Discharge Full	10.92	cfs
Slope Full	0.001697	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-18
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.057000	ft/ft
Diameter	18	in
Discharge	0.10	cfs

Results		
Depth	0.09	ft
Flow Area	0.05	ft²
Wetted Perimeter	0.76	ft
Top Width	0.72	ft
Critical Depth	0.12	ft
Percent Full	6.2	%
Critical Slope	0.022852	ft/ft
Velocity	2.19	ft/s
Velocity Head	0.07	ft
Specific Energy	0.17	ft
Froude Number	1.53	
Maximum Discharge	14.03	cfs
Discharge Full	13.04	cfs
Slope Full	0.000003	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	DC-19
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.025000	ft/ft
Diameter	18	in
Discharge	1.11	cfs

Results		
Depth	0.36	ft
Flow Area	0.33	ft^2
Wetted Perimeter	1.54	ft
Top Width	1.29	ft
Critical Depth	0.39	ft
Percent Full	24.2	%
Critical Slope	0.018124	ft/ft
Velocity	3.36	ft/s
Velocity Head	0.18	ft
Specific Energy	0.54	ft
Froude Number	1.17	
Maximum Discharge	9.29	cfs
Discharge Full	8.64	cfs
Slope Full	0.000413	ft/ft
Flow Type	Supercritical	

Flow Velocity Calculation
Worksheet

Project Description	
Worksheet	UC-1 – 100yr/6hr
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.00500	ft/ft
Diameter	60	in
Discharge	49.09	cfs

Results		
Depth	2.54	ft
Flow Area	10.00	ft^2
Wetted Perimeter	7.93	ft
Top Width	5.00	ft
Critical Depth	1.96	ft
Percent Full	50.7	%
Critical Slope	0.012399	ft/ft
Velocity	4.91	ft/s
Velocity Head	0.37	ft
Specific Energy	2.91	ft
Froude Number	0.61	
Maximum Discharge	103.01	cfs
Discharge Full	95.76	cfs
Slope Full	0.001313	ft/ft
Flow Type	Subcritical	

Flow Velocity Calculation Worksheet

Project Description	
Worksheet	SP2-1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.025	
Slope	0.005	ft/ft
Diameter	18	in
Discharge	2.86	cfs

Results		
Depth	0.96	ft
Flow Area	1.2	ft²
Wetted Perimeter	2.78	ft
Top Width	1.44	ft
Critical Depth	0.64	ft
Percent Full	64.0	%
Critical Slope	0.018854	ft/ft
Velocity	2.39	ft/s
Velocity Head	0.09	ft
Specific Energy	1.05	ft
Froude Number	0.46	
Maximum Discharge	4.15	cfs
Discharge Full	3.86	cfs
Slope Full	0.002742	ft/ft
Flow Type	Subcritical	

Lila Canyon Mine

APPENDIX 1 - Culvert Outlet Rip-Rap Apron Flow Velocity Calculations

Lila Canyon
Worksheet for Circular Channel

Project Description		
Worksheet	UC-1 -OUTLET Velocity - (100/6)	
Flow Element	Circular Channel	
Method	Manning's Formula	
Solve For	Channel Depth	

Input Data		
Mannings Coefficient	0.025	
Slope	0.009000	ft/ft
Diameter	60	in
Discharge	49.09	cfs

Results		
Depth	2.14	ft
Flow Area	8.0	ft²
Wetted Perimeter	7.14	ft
Top Width	4.95	ft
Critical Depth	1.96	ft
Percent Full	42.9	%
Critical Slope	0.012400	ft/ft
Velocity	6.10	ft/s
Velocity Head	0.58	ft
Specific Energy	2.72	ft
Froude Number	0.84	
Maximum Discharge	138.20	cfs
Discharge Full	128.47	cfs
Slope Full	0.001314	ft/ft
Flow Type	Subcritical	

Lila Canyon
Worksheet for Trapezoidal Channel

Project Description		
Worksheet	UC-1 - Apron Outlet - (100/6)	
Flow Element	Trapezoidal Channel	
Method	Manning's Formula	
Solve For	Channel Depth	

Input Data		
Mannings Coefficient	0.045	
Slope	0.001000	ft/ft
Left Side Slope	2.00	H : V
Right Side Slope	2.00	H : V
Bottom Width	9.00	ft
Discharge	49.09	cfs

Results		
Depth	2.41	ft
Flow Area	33.24	ft²
Wetted Perimeter	19.76	ft
Top Width	18.63	ft
Critical Depth	0.91	ft
Critical Slope	0.033554	ft/ft
Velocity	1.48	ft/s
Velocity Head	0.03	ft
Specific Energy	2.44	ft
Froude Number	0.19	
Flow Type	Subcritical	

Appendix 8-1

Reclamation Cost Estimates

Bonding Calculations
Horse Canyon MineC/007/013
Lila Canyon Section

Bond Summary

Direct Costs

Subtotal Demolition and Removal	$645,251.00	
Subtotal Backfilling and Grading	$417,838.00	
Subtotal Revegetation	$340,586.00	
Direct Costs	$1,403,675.00	
Indirect Costs		
Mob/Demob	$140,368.00	10.0%
Contingency	$70,184.00	5.0%
Engineering Redesign	$35,092.00	2.5%
Main Office Expense	$95,450.00	6.8%
Project Mainagement Fee	$35,092.00	2.5%
Subtotal Indirect Costs	$376,186.00	26.8%
Total Cost	$1,779,861.00	
Escalation factor		0.005
Number of years		3
Escalation	$26,832.00	
Reclamation Cost	$1,806,693.00	
Bond Amount (rounded to nearest $1,000) 2013 Dollars	$1,807,000.00	
Bond Posted Up to May 2007	$1,686,000.00	
Difference Between Cost Estimate and Bond	-$121,000.00	
Percent Difference	-6.70%	

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Office Bathhouse																			$105,253
	Shop Warehouse																			$124,630
	Security Shack																			$693
	Mine Substation																			$10,488
	Underground Power Lines																			left in place
	Water Treatment Plant																			$2,070
	Potable Water Tank																			1513
	Process Water Tank																			1513
	Sewer Tank																			$1,421
	Drain Field																			left in place
	Ventilation Fan																			$44,781
	Conveyor Tunnels to Coal Stockpile																			39595
	Conveyor ROM Stockpile to Crusher																			14011
	Conveyor Crusher to Loudout Bin																			$9,663
	Conveyor Loudout Bin Truck Loadout																			$588
	Reclaim Escape Tunnel Fan Fan House																			20369
	ConveyorStoragePileStakingTube																			11939
	Crusher Screen Plant																			5361
	Truck Scale to Loadout																			$8,490
	Coal Storage Bin																			$4,448
	Guard Rail																			27588
	Underground Pipes																			Left in Place
	Chain Link Fence																			$5,325
	Mine Facilities Rd Truck Loadout Rd																			$59,059
	Office Bathhouse Warehouse Parking																			$100,209
	Mine Parking																			$25,322
	Fuel Tanks																			$5,097
	Powder and Cap Magazine																			$2,460
	Culverts																			1952
	Old Horse Canyon Fan Portals in Lila Canyon																			$5,000
	Pole Barn																			$6,413
	Total																			$645,251

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Office Bathhouse																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF	150	100	15												
	Structure's Vol. Demolished															FT		225000	CF	69750
	Rubble's Weight (exclude steel)																0.3	2500	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		600	ton	21000
	Subtotal																			90750
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY	150	100	1												
	Concrete's Vol. Demolished															FT		556	CY	5516
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY												1.3	723	CY	
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													723	CY	1005
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													723	CY	2487
	Subtotal																	723	CY	5495
																				14503
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			105253

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Shop Warehouse																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF	150	100	20								FT		300000	CF	93000
	Structure's Vol. Demolished																0.3	3333	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		800	ton	28000
	Subtotal																			121000
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY	150	100	0.25								FT		139	CY	1379
	Concrete's Vol. Demolished																1.3	181	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY													181	CY	252
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													181	CY	623
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													181	CY	1376
	Subtotal																			3630
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			124630

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Security Shack																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF	20	10	8								FT		1600	CF	496
	Structure's Vol. Demolished																0.3	18	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		4	ton	140
	Subtotal																			636
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY	20	10	0.25								FT		2	CY	20
	Concrete's Vol. Demolished																1.3	3	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY													3	CY	4
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													3	CY	10
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													3	CY	23
	Subtotal																			57
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			693

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Mine Substation																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost	Mechanical equipment heavy	15055 300 3600	615	/ton															
	Dismantling Cost											4			4	ton		16	ton	9840
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
																				9840
	Equipment 's Disposal Cost	Chain link remove 8'-10'	02220 220 1700	2.92	/LF	160														
	Dismantling Cost															FT		160	FT	467
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
																				467
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY	20	20	0.5												
	Concrete's Vol. Demolished														4	FT		7	CY	69
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY												1.3	9	CY	
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													9	CY	13
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													9	CY	31
	Subtotal																	9	CY	68
																				181
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			10488

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Underground Power Lines																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			left in place

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Water Treatment Plant																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF						1800					CF		1800	CF	558
	Structure's Vol. Demolished																0.3	20	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		5	ton	175
	Subtotal																			733
	Equipment 's Disposal Cost																			
	Dismantling Cost	3000 gal. to 5000 gal. tank	02115 200 0110	545	Ea.										1	EA		1	EA	545
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs	3000 gal. to 5000 gal. tank	02115 200 1023	690	Ea.										1	EA		1	EA	690
	Subtotal																			1235
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY	15	15	0.5								FT		4	CY	40
	Concrete's Vol. Demolished																1.3	5	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY													5	CY	7
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													5	CY	17
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													5	CY	38
	Subtotal																			102
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			2070

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Pole Barn																			
	Structure's	Steel Bld.	02220 110	0.31	/CF	50	30	10								FT		15000	CF	4650
	Structure's Vol. Demolished																0.3	167	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal C	ECDC	ECDC	35	/TON								480			lb/cf		40	ton	1400
	Subtotal																			6050
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition	Concrete c	ConcreteD	9.92	/CY	50	30	0.25								FT		14	CY	139
	Concrete's Vol. Demolished																1.3	18	CY	
	Loading C	Front end	02315 424	1.39	/CY													18	CY	25
	Transporta	12 CY (16	02315 490	3.44	/CY													18	CY	62
	Disposal C	On site dis	02220 240	7.6	/CY													18	CY	137
	Subtotal																			363
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			6413

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Potable Water Tank																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF			20	15							FT		3534	CF	1096
	Structure's Vol. Demolished																0.3	39	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		9	ton	315
	Subtotal																			1411
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY	15	15	0.5								FT		4	CY	40
	Concrete's Vol. Demolished																1.3	5	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY													5	CY	7
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													5	CY	17
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													5	CY	38
	Subtotal																			102
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			1513

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Process Water Tank																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF			20	15											
	Structure's Vol. Demolished															FT		3534	CF	1096
	Rubble's Weight (exclude steel)																0.3	39	CY	
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		9	ton	315
	Subtotal																			1411
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY	15	15	0.5												
	Concrete's Vol. Demolished															FT		4	CY	40
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY												1.3	5	CY	
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													5	CY	7
	Disposal Costs	*On site disposal*	02220 240 5550	7.6	/CY													5	CY	17
	Subtotal																	5	CY	38
																				102
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			1513

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Sewer Tank																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Remove Tank	3000 gal. to 5000 gal. tank	02115 200 0110	545	Ea.										1	EA		1	EA	545
	Remove Sludge	3000 gal. to 5000 gal. tank	02115 200 0300	186	Ea.										1	EA		1	EA	186
	Disposal Costs	3000 gal. to 5000 gal. tank	02115 200 1023	690	Ea.										1	EA		1	EA	690
	Subtotal																			1421
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			1421

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Drain Field																			
	Structure's Demolition Cost	will remain in place at reclamation																		
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			left in place

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Ventilation Fan																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost	Mechanical equipment heavy	15055 300 3600	615	/ton							10			4	ton		40	ton	24600
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			24600
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs	Helicopter	Willow Creek 1	2000	/HR									10		HR		10	HR	20000
	Disposal Costs																			
	Subtotal																			20000
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY	20	20	0.5								FT		7	CY	69
	Concrete's Vol. Demolished																1.3	9	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY													9	CY	13
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													9	CY	31
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													9	CY	68
	Subtotal																			181
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			44781

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Conveyor Tunnels to Coal Stockpile																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF	810	6	20								FT		97200	CF	30132
	Structure's Vol. Demolished																0.3	1080	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		259	ton	9065
	Subtotal																			39197
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY						15							15	CY	149
	Concrete's Vol. Demolished																1.3	20	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY													20	CY	28
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													20	CY	69
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													20	CY	152
	Subtotal																			398
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			39585

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Conveyor ROM Stockpile to Crusher																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF	675	5	10								FT		33750	CF	10463
	Structure's Vol. Demolished																0.3	375	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		90	ton	3150
	Subtotal																			13613
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY						15							15	CY	149
	Concrete's Vol. Demolished																1.3	20	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY													20	CY	28
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													20	CY	69
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													20	CY	152
	Subtotal																			398
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			14011

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Conveyor Crusher to Loudout Bin																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF	230	5	20								FT		23000	CF	7130
	Structure's Vol. Demolished																0.3	256	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		61	ton	2135
	Subtotal																			9265
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY						15							15	CY	149
	Concrete's Vol. Demolished																1.3	20	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY													20	CY	28
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													20	CY	69
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													20	CY	152
	Subtotal																			398
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			9663

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Conveyor Loudout Bin Truck Loadout																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF	5	5	20								FT		500	CF	155
	Structure's Vol. Demolished																0.3	6	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		1	ton	35
	Subtotal																			190
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY						15							15	CY	149
	Concrete's Vol. Demolished																1.3	20	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY													20	CY	28
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													20	CY	69
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													20	CY	152
	Subtotal																			398
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			588

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Reclaim Escape Tunnel Fan Fan House																			
	Currugated Steel	Steel Bld. Large	02220 110 0012	0.31	/CF						26880					CF		26880	CF	8333
	Escape Tunnel	Steel Bld. Large	02220 110 0012	0.31	/CF						1257					CF		1257	CF	390
	Fan	Steel Bld. Large	02220 110 0012	0.31	/CF						64					CF		64	CF	20
	Fan House	Steel Bld. Large	02220 110 0012	0.31	/CF						512					CF		512	CF	159
	Structure's Vol. Demolished																0.3	319	CF	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		77	ton	2695
	Subtotal																			11597
	Excavation and Backfill																			
	Reclaim Tunnel	Excavation Bulk Bank 2 CY (322BL)	02315 424 0260	1.7	/CY	350	14	10								FT		1815	CY	3086
	Reclaim Tunnel	Backfill Trench Mininal Haul 2 1/4 CY	02315 610 3080	1.89	/CY													1815	CY	3430
	Escape Tunnel	Excavation Bulk Bank 2 CY (322BL)	02315 424 0260	1.7	/CY	325	4	10								FT		481	CY	818
	Escape Tunnel	Backfill Trench Mininal Haul 2 1/4 CY	02315 610 3080	1.89	/CY													481	CY	909
	Subtotal																			8243
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY						20							20	CY	198
	Concrete's Vol. Demolished																1.3	26	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.01	/CY													26	CY	26
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	2.92	/CY													26	CY	76
	Disposal Costs	On site disposal	02220 240 5550	8.8	/CY													26	CY	229
	Subtotal																			529
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			20369

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	ConveyorStoragePileStakingTube																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF			80	20							FT		25133	CF	7791
	Structure's Vol. Demolished																0.3	279	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		67	ton	2345
	Subtotal																			10136
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY	25	25	3								FT		69	CY	684
	Concrete's Vol. Demolished																1.3	90	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY													90	CY	125
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													90	CY	310
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													90	CY	684
	Subtotal																			1803
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			11939

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Crusher Screen Plant																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF						12000					CF		12000	CF	3720
	Structure's Vol. Demolished																0.3	133	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		32	ton	1120
	Subtotal																			4840
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY						20							20	CY	198
	Concrete's Vol. Demolished																1.3	26	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.39	/CY													26	CY	36
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	3.44	/CY													26	CY	89
	Disposal Costs	On site disposal	02220 240 5550	7.6	/CY													26	CY	198
	Subtotal																			521
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			5361

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Truck Scale to Loadout																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF						18850					CF		18850	CF	5844
	Structure's Vol. Demolished																0.3	209	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		50	ton	1750
	Subtotal																			7594
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	*Concrete demolition*	ConcreteDemo1	9.92	/CY						34							34	CY	337
	Concrete's Vol. Demolished																1.3	44	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.01	/CY													44	CY	44
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	2.92	/CY													44	CY	128
	Disposal Costs	On site disposal	02220 240 5550	8.8	/CY													44	CY	387
	Subtotal																			896
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			8490

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Coal Storage Bin																			
	Structure's Demolition Cost	Steel Bld. Large	02220 110 0012	0.31	/CF						10000					CF		10000	CF	3100
	Structure's Vol. Demolished																0.3	111	CY	
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel	ECDC	ECDC	35	/TON								480			lb/cf		27	ton	945
	Subtotal																			4045
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost	Concrete demolition	ConcreteDemo1	9.92	/CY						15							15	CY	149
	Concrete's Vol. Demolished																1.3	20	CY	
	Loading Cost	Front end loader 3 CY	02315 424 1300	1.01	/CY													20	CY	20
	Transportation Cost	12 CY (16 Ton) Dump Truck 1/2 mi. r	02315 490 0320	2.92	/CY													20	CY	58
	Disposal Costs	On site disposal	02220 240 5550	8.8	/CY													20	CY	176
	Subtotal																			403
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			4448

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Guard Rail																			
	Structure's Demolition Cost	Guiderail remove	02220 240 0800	18.15	LF	1520										FT		1520	FT	27588
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			27588
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			27588

Post removal is in the linear foot calculation

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Underground Pipes	will remain in place at reclamation																		
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			Left in Place

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Chain Link Fence																			
	Structure's Demolition Cost	Chain link remove 8'-10'	02220 220 1700	3.55	/LF	1500										FT		1500	FT	5325
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			5325
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			5325

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Mine Facilities Rd Truck Loadout Rd																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Facilities Road																			
	Asphalt Demolition																			
	Demolition Cost	Pavement Removal 4-6"	02220 250 5050	7.6	/SY	1750	24									SY		4667	SY	35469
	Asphalt's Vol. Demolished							4.00								IN	1.3	674	CY	
	Loading Cost																			
	Transportation Cost	16.5 CY Dump Trailer 10 mi. rnd. trip	02315 490 1120	9.75	/CY															
	Disposal Costs	ECDC	ECDC	35	/TON								1			CY/Ton		674	CY	23590
	Subtotal																			59059
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Total																			59059

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Office Bathhouse Warehouse Parking																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Office Area																			
	Asphalt Demolition																			
	Demolition Cost	Pavement Removal 4-6"	02220 250 5050	7.6	/SY	475	150									SY		7917	SY	60169
	Asphalt's Vol. Demolished							4.00								IN	1.3	1144	CY	
	Loading Cost																			
	Transportation Cost	16.5 CY Dump Trailer 10 mi. rnd. trip	02315 490 1120	9.75	/CY															
	Disposal Costs	ECDC	ECDC	35	/TON								1			CY/Ton		1144	CY	40040
	Subtotal																			100209
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Total																			100209

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Mine Parking																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Parking Lot																			
	Asphalt Demolition																			
	Demolition Cost	Pavement Removal 4-6"	02220 250 5050	7.6	/SY	100	200									SY		2222	SY	16887
	Asphalt's Vol. Demolished							3.00								IN	1.3	241	CY	
	Loading Cost																			
	Transportation Cost	16.5 CY Dump Trailer 10 mi. rnd. trip	02315 490 1120	9.75	/CY															
	Disposal Costs	ECDC	ECDC	35	/TON								1			CY/Ton		241	CY	8435
	Subtotal																			25322
	Total																			25322

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Fuel Tanks																			
	Structure's Demolition Cost																			
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			
	Equipment 's Disposal Cost																			
	Removal Tanks	3000 gal. to 5000 gal. tank	02115 200 0110	726	Ea.										3	EA		3	EA	2178
	Remove sludge water products	3000 gal. to 5000 gal. tank	02115 200 0300	247	Ea.										3	EA		3	EA	741
	Haul tank recycle center	3000 gal. to 5000 gal. tank	02115 200 1023	726	Ea.										3	EA		3	EA	2178
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			5097
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			5097

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Powder and Cap Magazine																			
	Structure's Demolition Cost	Mechanical equipment heavy	15055 300 3600	615	/ton							4				TON		4	TON	2460
	Structure's Vol. Demolished																			
	Rubble's Weight (exclude steel)																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Non Steel Truck																			
	Transportation Cost Non Steel Drive																			
	Disposal Cost Non Steel																			
	Steel's Weight																			
	Truck's Capacity																			
	Haulage																			
	Transportation Cost Steel Truck																			
	Transportation Cost Steel Truck Drive																			
	Disposal Cost Steel																			
	Subtotal																			2460
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			2460

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Culverts																			
	DC-5	Excavation Bulk Bank 2 CY (322BL)	02315 424 0260	1.7	/CY	50	1.5	3								FT		8	CY	14
	DC-5	Backfill Trench Mininal Haul 2 1/4 CY	02315 610 3080	1.53	/CY	50	1.5	3								FT		8	CY	12
	DC-6	Excavation Bulk Bank 2 CY (322BL)	02315 424 0260	1.7	/CY	80	2	3								FT		18	CY	31
	DC-6	Backfill Trench Mininal Haul 2 1/4 CY	02315 610 3080	1.53	/CY	80	2	3								FT		18	CY	28
	DC-7	Excavation Bulk Bank 2 CY (322BL)	02315 424 0260	1.7	/CY	110	2	3								FT		24	CY	41
	DC-7	Backfill Trench Mininal Haul 2 1/4 CY	02315 610 3080	1.53	/CY	110	2	3								FT		24	CY	37
	DC-8	Excavation Bulk Bank 2 CY (322BL)	02315 424 0260	1.7	/CY	85	1.5	3								FT		14	CY	24
	DC-8	Backfill Trench Mininal Haul 2 1/4 CY	02315 610 3080	1.53	/CY	85	1.5	3								FT		14	CY	21
	DC-9	Excavation Bulk Bank 2 CY (322BL)	02315 424 0260	1.7	/CY	40	1.5	3								FT		7	CY	12
	DC-9	Backfill Trench Mininal Haul 2 1/4 CY	02315 610 3080	1.53	/CY	40	1.5	3								FT		7	CY	11
	UC-1	Excavation Bulk Bank 2 CY (322BL)	02315 424 0260	1.7	/CY	480	5	6								FT		533	CY	906
	UC-1	Backfill Trench Mininal Haul 2 1/4 CY	02315 610 3080	1.53	/CY	480	5	6								FT		533	CY	815
	Subtotal																			1952
	Equipment 's Disposal Cost																			
	Dismantling Cost																			
	Equipment 's Vol. Demolished																			
	Loading Costs																			
	Transport Costs																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Concrete Demolition																			
	Demolition Cost																			
	Concrete's Vol. Demolished																			
	Loading Cost																			
	Transportation Cost																			
	Disposal Costs																			
	Subtotal																			
	Total																			1952

Ref.	Description Lila Old Fan Portals	Materials	Means Reference Number	Unit Cost	Unit													Quantity	Unit	Cost
	Structure's Demolition Cost			5000	1															5,000
	Total																			

TOPSOIL MOVEMENT & CONSTRUCTION RECORD

PHASE I

UTAHAMERICAN ENERGY

LILA CANYON MINE

December 2008-February 2009

PROFESSIONAL ENGINEER
No. 22-150267-2203
J. THOMAS
PALUSO
9/17/09
STATE OF UTAH

Prepared by

J. T. Paluso, P. E.

EIS ENVIRONMENTAL & ENGINEERING CONSULTING
31 North Main, Helper, Utah 84526

Scope of Work

EIS Environmental & Engineering Consulting (EIS) was hired by UtahAmerican Energy, Inc (UEI) to monitor the removal of topsoil from the Lila Canyon Mine for Phase I construction activities.

Phase I consisted of the following activities:

- Construct stormwater detention ponds. These ponds are needed to contain all runoff coming from disturbed areas.
- Construct portal access road. Due to the length of time required to construct the underground rock slopes, it was necessary to construct the portal access road during Phase I of the construction activities.
- Remove topsoil from the west portion of the coal stockpile area. This area was needed to provide storage space for material generated during the construction of the underground rock slopes.
- Remove topsoil from the warehouse pad area. This area was also needed to provide storage space for material generated from the rock slope construction work.
- Construct employee parking and temporary bathhouse area. This area was needed to provide parking space and bathhouse facilities for the crews developing the rock slopes.

During Phase I activities the follow amounts of topsoil were generated from the various locations:

LOCATION	LOADS	VOLUME (Yd^3)
Employee Parking Lot	378	12,110
Portal Road	238	7,622
Storm Water Detention Pond	154	4,943
Small Detention Pond	61	1,940
Coal Stockpile	269	8,601
Warehouse Pad	137	4,385
Topsoil Area	Push with Dozer	646
TOTAL		**40,247 Yd^3**

LILA CANYON MINE
TOPSOIL & CONSTRUCTION ACTIVITY RECORD

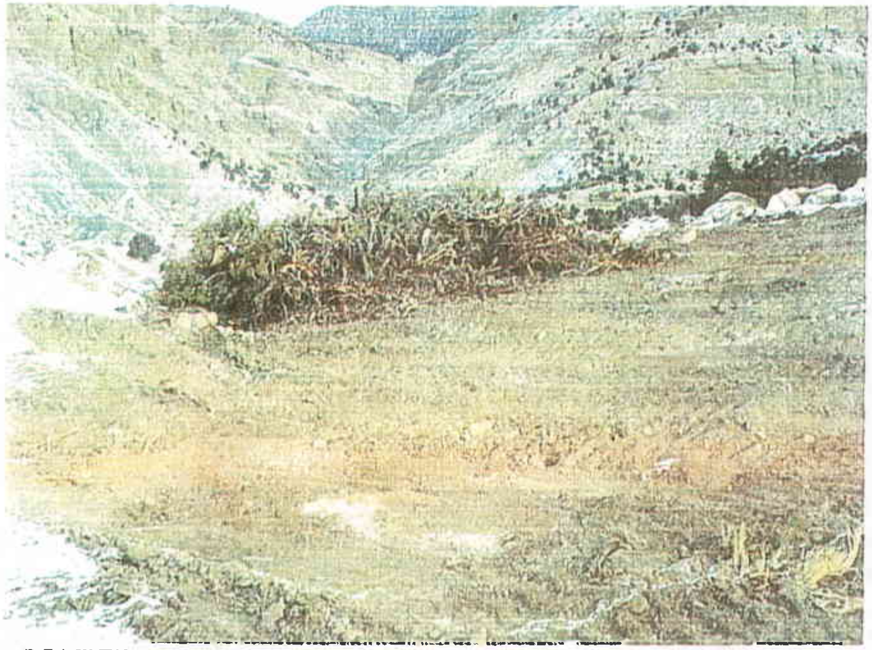
December 24, 2008 (Mel Coonrod & Matt Serfustini)

The following activities were observed during this visit:

1. Fill material was being removed from the stormwater detention pond. Some topsoil still remains to be removed from the pond area.
2. Work on portal access road was proceeding.
3. Topsoil was being removed from employee parking area.
4. Topsoil had been removed from west end of coal pile area.

PHOTOGRAPHS

LOOKING SOUTH TOWARDS TOPSOIL STORAGE AREA

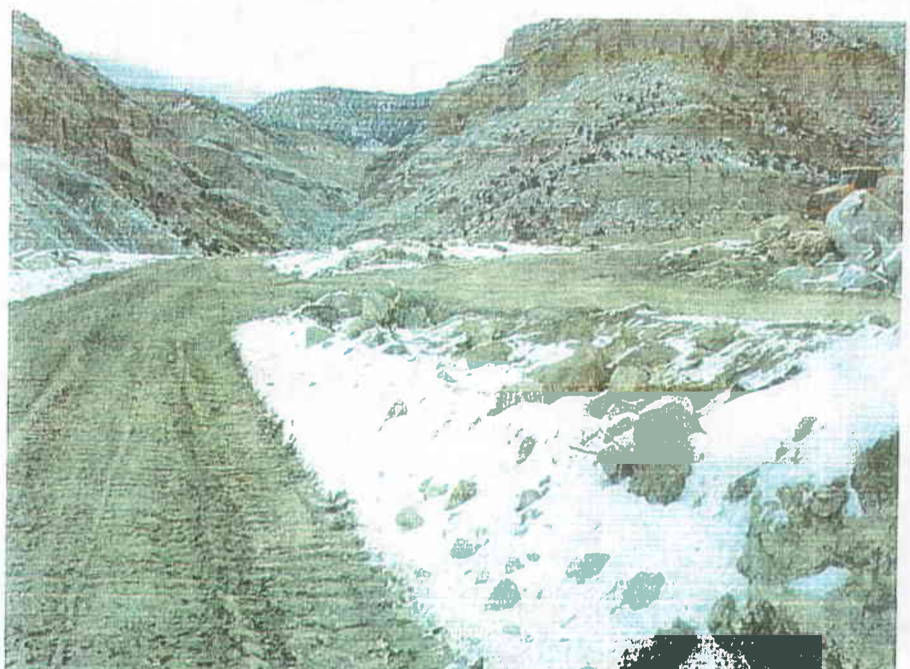


MATERIAL REMOVED FROM TOPSOIL STORAGE SITE

PORTAL ACCESS ROAD TOPSOIL NORTH OF COAL STOCKPILE, PHOTO TAKEN LOOKING EAST

SOIL PROFILE ON PORTAL ACCESS ROAD LOOKING NORTH, TAKEN ADJACENT TO PRIOR PHOTOGRAPH

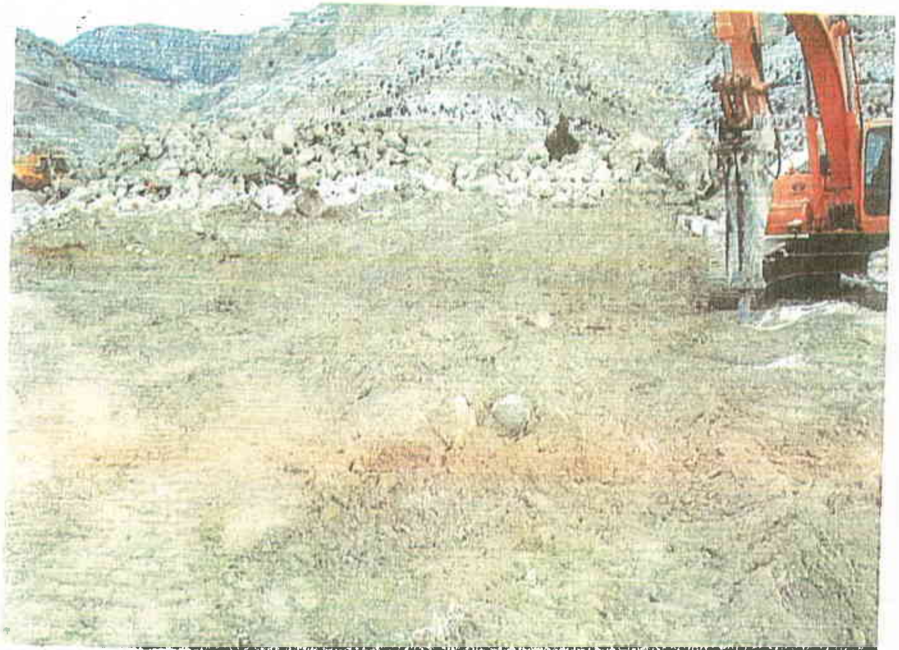
TOPSOIL REMOVAL SOUTH END OF EMPLOYEE PARKING LOT LOOKING SOUTH EAST



SOUTH OF LOADOUT STATION LOOKING NORTH

SOUTH OF LOADOUT STATION LOOKING SOUTH

SOIL PROFILE AT THE SAME LOCATION AS THE TWO PREVIOUS PHOTOGRAPHS


BOULDER REMOVAL SOUTH OF LOADOUT STATION LOOKING NORTH


EMPLOYEE PARKING AREA LOOKING SOUTH

December 30, 2008(Tom Paluso)

The following activities were observed during my site visit:

1. Fill material was being removed from portal access road. Contractor was working on side slopes on the portal access road.
2. Topsoil was being removed from employee parking area and delivered to the topsoil storage area.
3. Contractor was breaking large rocks on west end of coal storage pile. The large rocks were being reduced to make it easier to obtain necessary compaction with fill material being deposited in this area.

PHOTOGRAPHS

TOPSOIL REMOVAL FROM EMPLOYEE PARKING AREA

LOOKING SOUTHWEST OVER PROJECT AREA

January 7, 2009 (Tom Paluso)

The following activities were observed during site visit:

1. Contractor was transporting topsoil from office area to topsoil site.
2. Portal access road grade was being lowered northeast of employee's parking area.
3. Hydraulic hoes were working on portal area.

The stormwater detention pond still has approximately 15 percent of the topsoil to be removed. This material is located in the southeast corner of the pond. According to Shane Campbell this material was intentionally left to provide work during bad weather conditions. Shane also mentioned that topsoil removal at the warehouse site should probably start on January 15 or 16.

PHOTOGRAPHS

TOPSOIL REMOVAL FROM OFFICE AREA

BOULDERS BEING SEPARATED FROM TOPSOIL MATERIAL

LOWER PORTAL ACCESS ROAD GRADE

FILL MATERIAL BEING REMOVED FROM PORTAL ACCESS ROAD

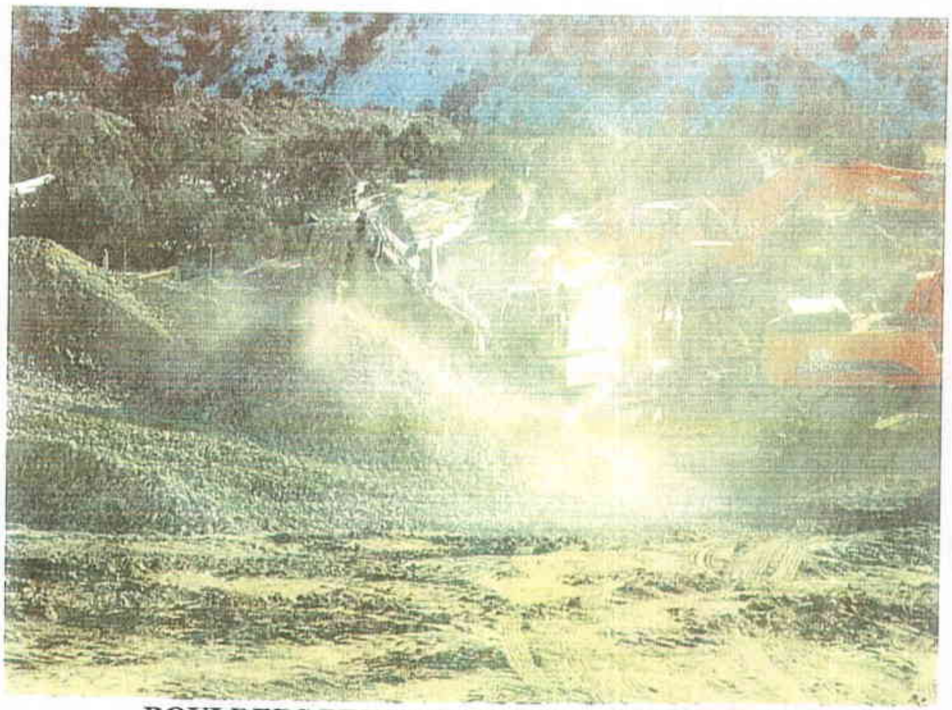
HYDRAULIC BACKHOES WORKING ON PORTAL AREA

January 15, 2009 (Tom Paluso)

The following activities were observed during site visit:

1. Large boulders are being crushed to make gravel for this project.
2. Boulders are being stockpiled at future coal stockpile site. These boulders will be crushed into gravel.
3. Work on the portal area is still in progress.

PHOTOGRAPHS



BOULDERS BEING CRUSHED INTO GRAVEL

CRUSHED GRAVEL PILE

BOULDERS BEING STOCKPILED FOR CRUSHING

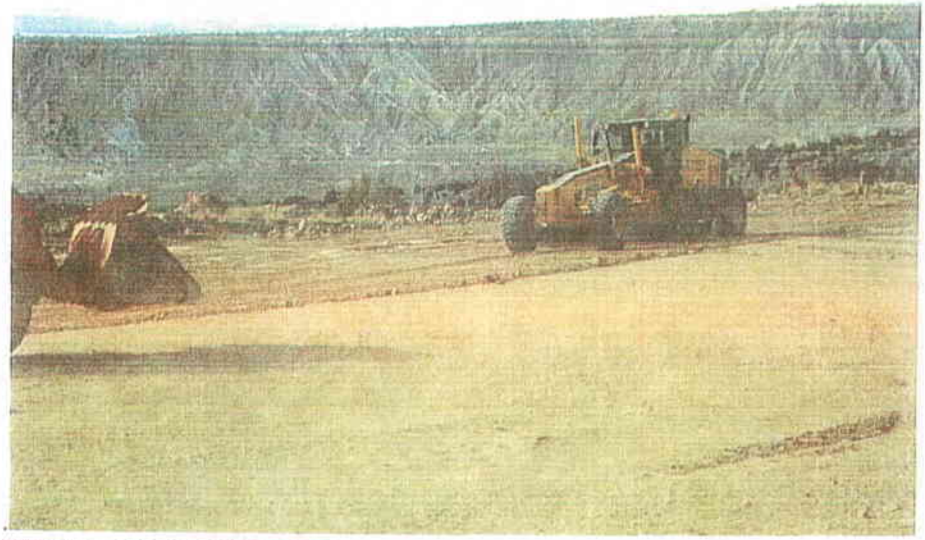
January 28, 2009 (Tom Paluso)

The following activities were observed during site visit:

1. Removing material from north end of parking lot.
2. Removing topsoil from stacking tube area.
3. Employee parking lot grading.

PHOTOGRAPHS

PARKING LOT MATERIAL REMOVAL

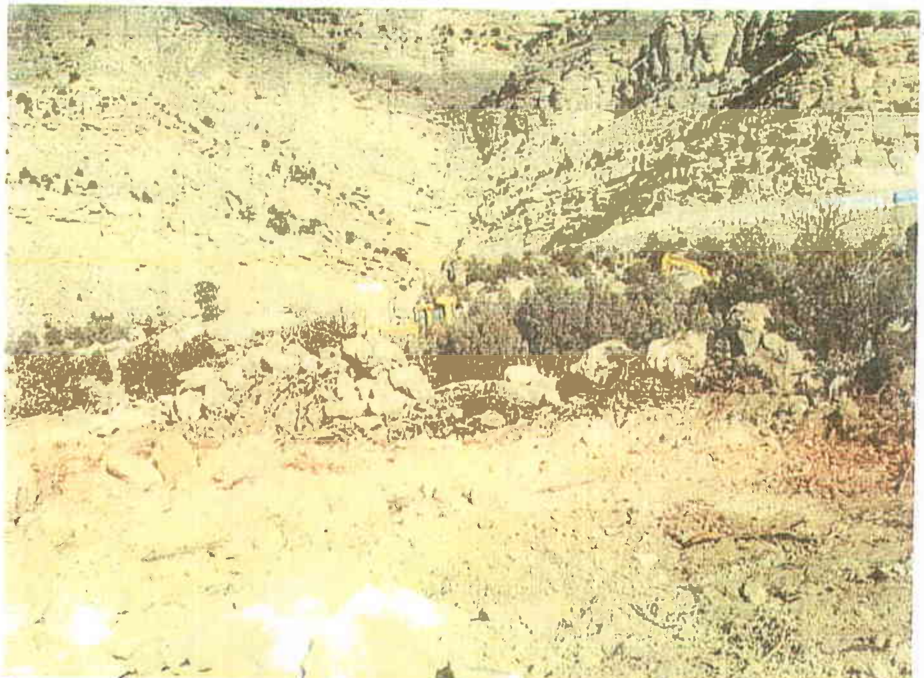


FINAL GRADING WEST END OF EMPLOYEE PARKING AREA

EMPLOYEE PARKING LOOKING NORTH WITH CRUSHED GRAVEL PILE

BOULDER REMOVAL FROM STACKING TUBE AREA LOOKING EAST

TOPSOIL REMOVAL FROM STACKING TUBE AREA LOOKING NORTH



STACKING TUBE AREA LOOKING EAST TOWARDS PORTALS

EAST OF STACKING TUBE LOOKING WEST

January 29, 2009 (Tom Paluso)

The following activities were observed during site visit:

1 Removing material from north end of parking lot.
2 Removing topsoil from stacking tube area.
3 Employee parking lot grading.

PHOTOGRAPHS

TOPSOIL PROFILE BY STACKING TUBE AREA

CLOSE-UP OF TOPSOIL PROFILE

February 6, 2009 (Tom Paluso)

The following activities were observed during site visit:

1. Removing topsoil from shop-warehouse area.
2. Completing work around silo area.

PHOTOGRAPHS

LOOKING SOUTHEAST FROM SILO AREA, TOPSOIL IS BEING COLLECTED

COLLECTING BOULDERS AND VEGETATION

LOOKING NORTHEAST FROM SILO AREA, TOPSOIL HAS BEEN REMOVED

February 18, 2009 (Tom Paluso)

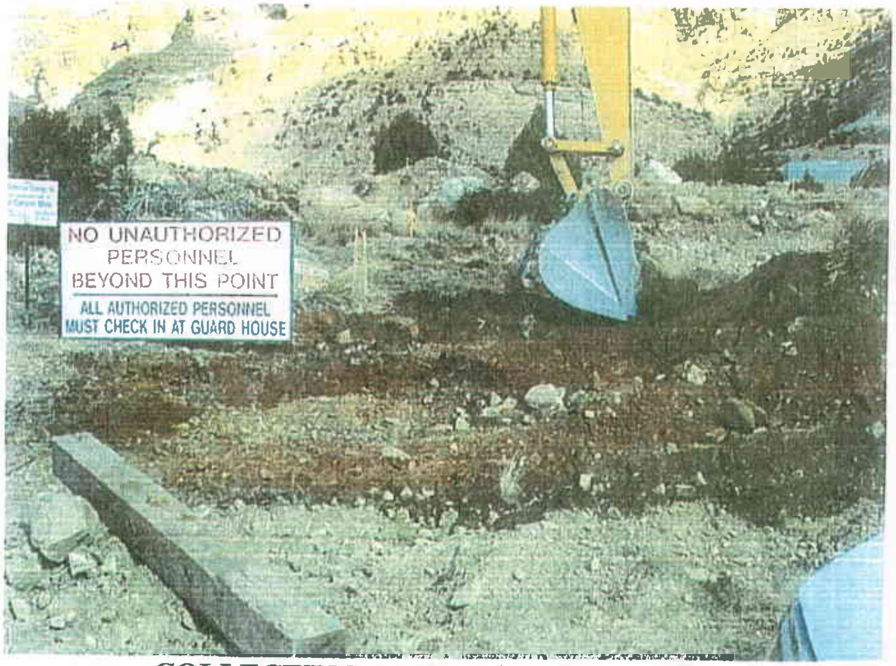
The following activities were observed during site visit:

1. Removing topsoil from small Stormwater Detention Pond.
2. Removing remaining topsoil from large Stormwater Detention Pond.
3. Working on final grade for Portal Access Road

PHOTOGRAPHS

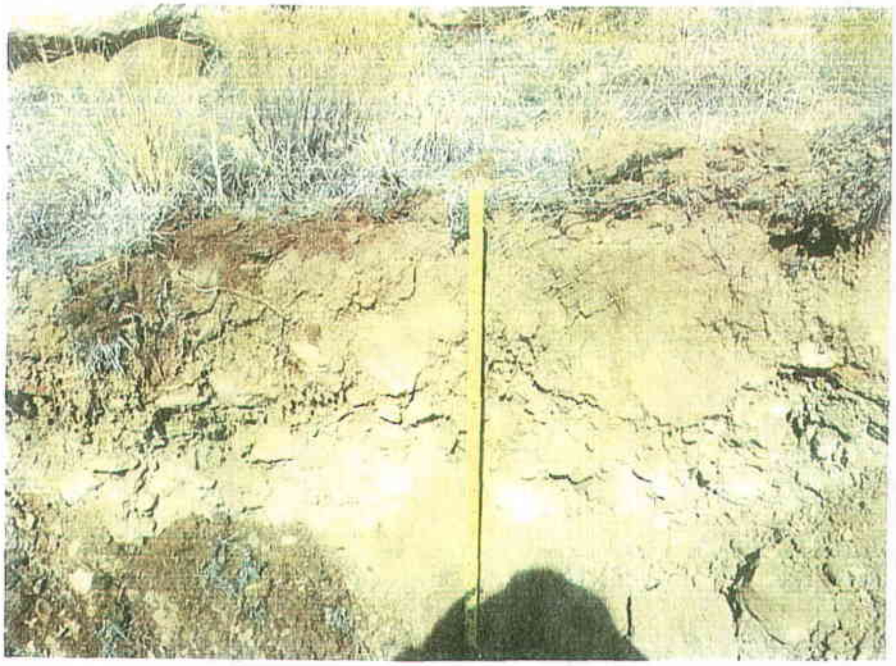
SIGN LOCATED BY CONSTRUCTION OFFICE & NEAR SMALL STORMWATER DETENTION POND

COLLECTING TOPSOIL AT SMALL STORMWATER RETENTION POND (SRP)



COLLECTING TOPSOIL AT SMALL SRP

REMOVING BOULDER FROM SMALL SRP



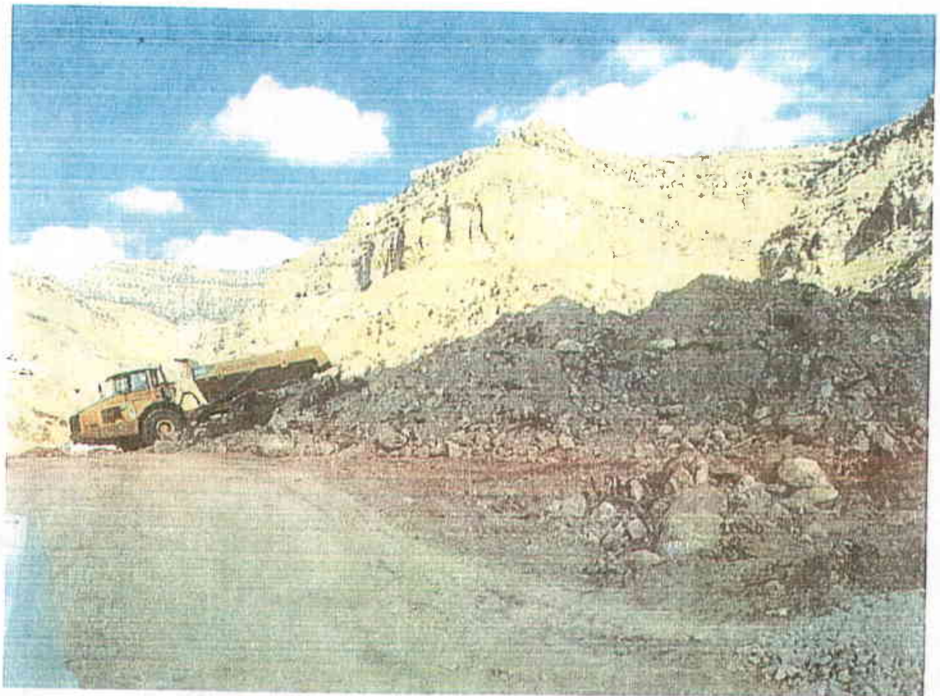
NORTHEAST SOIL PROFILE

SOUTHEAST SOIL PROFILE

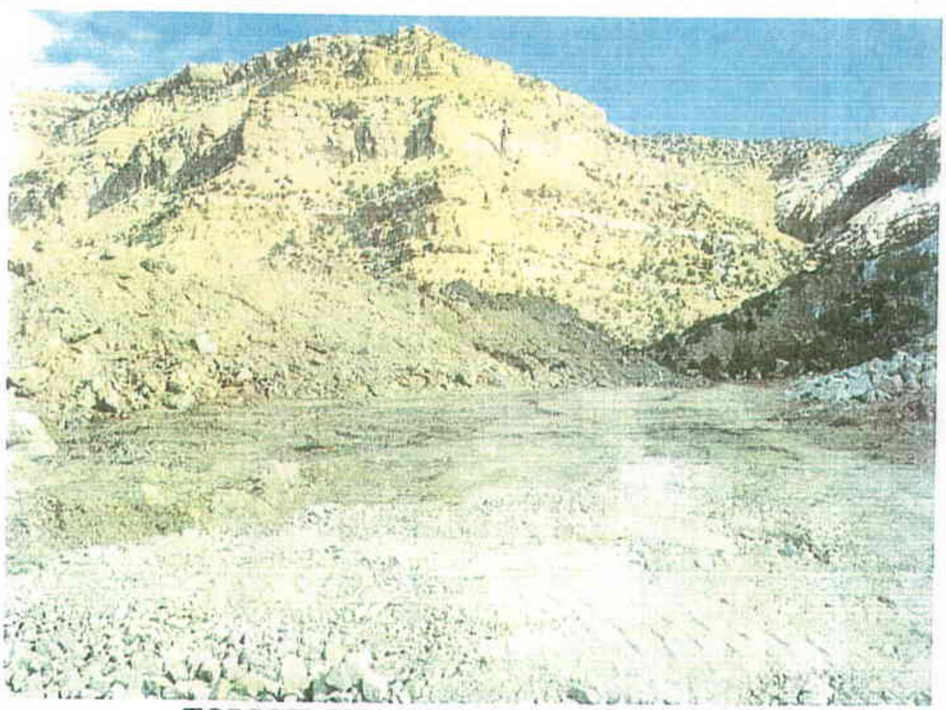
REMOVE REMAINING MATERIAL FROM LARGE STORMWATER RETENTION POND (SRP)

WEST END LARGE SRP

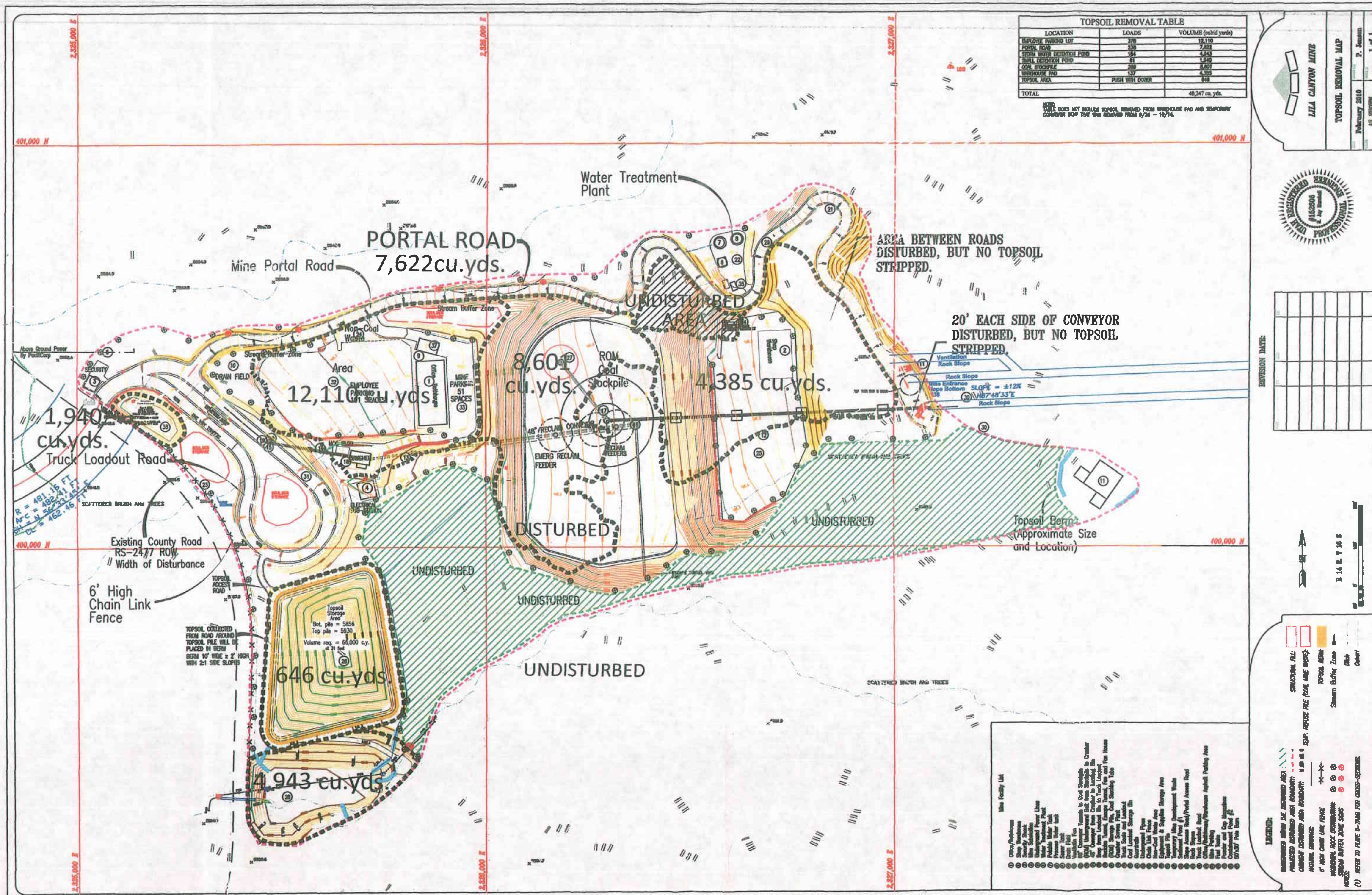
FINAL WORK ON PORTAL ROAD



TOPSOIL PILE LOOKING NORTHEAST



TOPSOIL PILE LOOKING SOUTH EAST



TOPSOIL REMOVAL TABLE

LOCATION	LOADS	VOLUME (cubid yards)
EMPLOYEE PARKING LOT	378	12,110
PORTAL ROAD	239	7,622
STORM WATER DETENTION POND	154	4,943
SMALL DETENTION POND	61	1,940
COAL STOCKPILE	269	8,601
WAREHOUSE PAD	137	4,385
TOPSOIL AREA	PUSH WITH DOZER	646
TOTAL		40,247 cu. yds.

NOTE:
TABLE DOES NOT INCLUDE TOPSOIL REMOVED FROM WAREHOUSE PAD AND TEMPORARY CONVEYOR BENT THAT WAS REMOVED FROM 9/24 – 10/14.